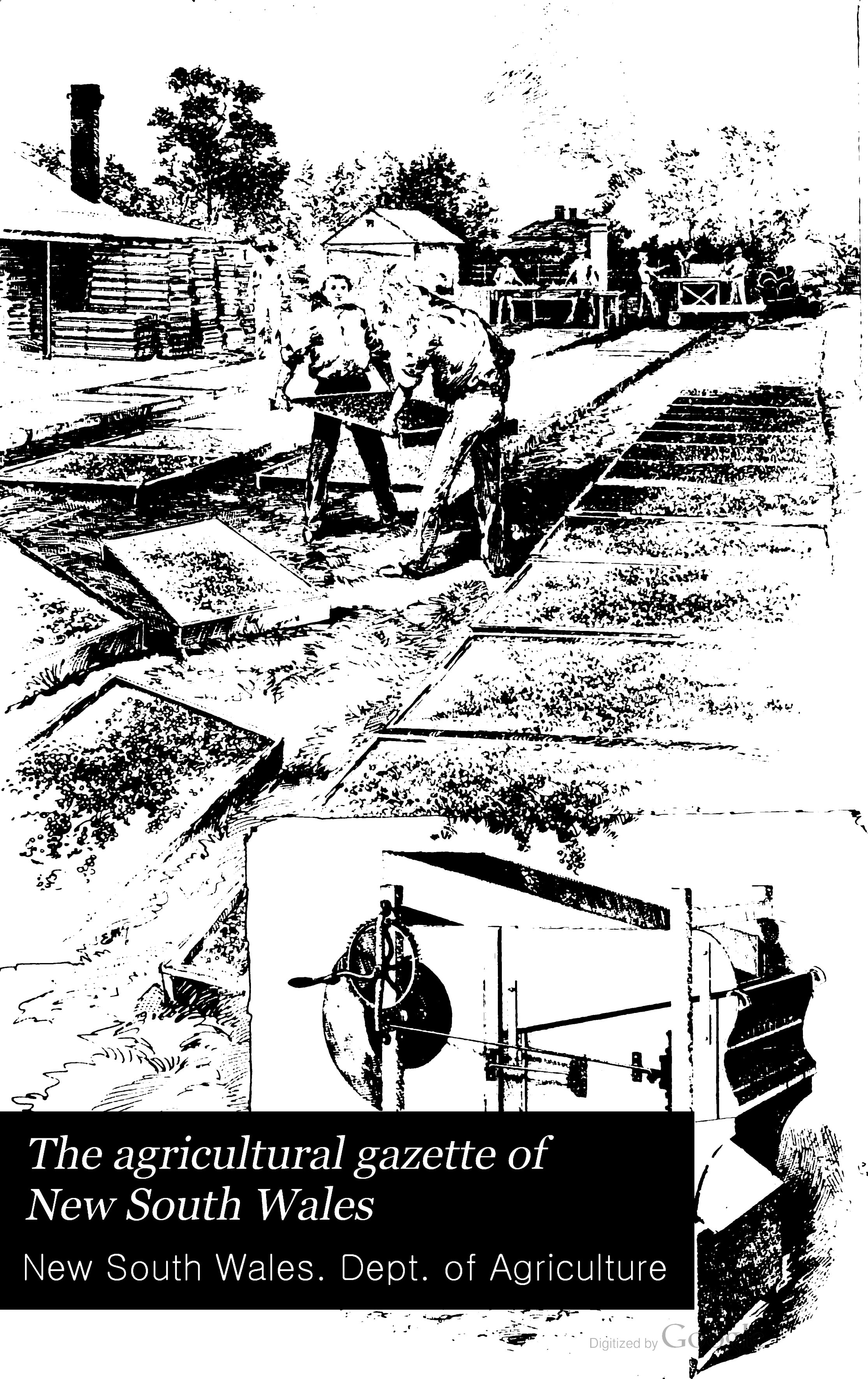
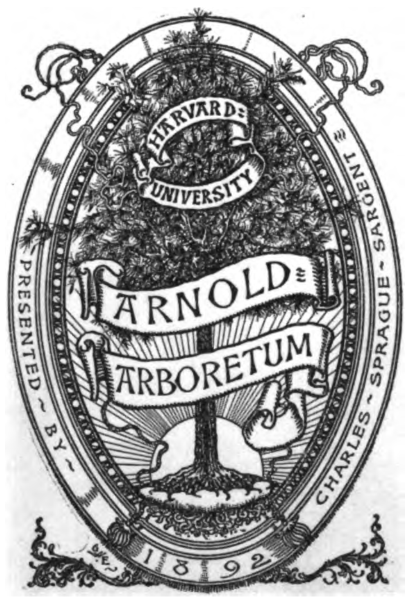


The agricultural gazette of New South Wales

New South Wales. Dept. of Agriculture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1892

THE

AGRICULTURAL GAZETTE

OF

NEW SOUTH WALES,

PUBLISHED BY

THE DEPARTMENT OF AGRICULTURE.

VOL. IV. PART 1.

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1893.

IT is with considerable satisfaction that we introduce to our readers the initial part of the Fourth Volume of the *Agricultural Gazette*. During the last three years our efforts have naturally called forth a certain amount of adverse criticism, which has as a general rule been of a friendly character, emanating evidently from a desire to assist the Department in its efforts to a wider dissemination of useful information. Probably the most frequent theme has been that some of the articles were of too scientific a character to be comprehended by the mass of the agriculturists, and, while admitting that this, to a certain extent, has been justified, there is a phase of the question which, apparently, has not occurred to our critics. The *Agricultural Gazette*, while being an organ published mainly for the benefit of agriculturists, is also a means of communication with scientists engaged in investigations in all parts of the civilised world. It places before these gentlemen, in scientific language, intelligible alike to all nations of the earth, the stages which have been reached in similar investigations which are being pursued here, and as these scientists adopt a similar course with regard to their discoveries, the *Gazette* has been the means of preventing a waste of time and energy, and of keeping the Department in touch with the latest discoveries of a scientific nature tending to benefit agriculture. It will be seen, therefore, that any drastic change in the direction of popularity is a matter for very careful consideration. It is claimed, however, that during the year just closed an effort has been made to comply with the desire for popular literature. The scientific articles have been clothed

in the simplest possible language, and while the necessary technical descriptions of insects, fungi, &c., may not have been of interest to all practical agriculturists, the remedies and practical suggestions made as a direct result of the previous scientific examination have always been simple and practical, as many subsequent experimenters have testified. The Department has also endeavoured, by means of numerous illustrations, to bring before the farming community many valuable aids to the more economical working of their farms, orchards, and vineyards.

As the sole desire of the Department, in fact, its reason for existence, is to benefit those settled on the land, we shall be not misunderstood in asking for more energetic co-operation on the part of those we wish to benefit. A column was opened in which it was proposed to publish matter of an interesting character emanating from local Agricultural Societies. It was, and is still, thought that amongst the members of these societies would be farmers who could supply valuable facts on subjects connected with their various industries. It appeared also that at the societies' meetings interesting matter would at times be discussed which might well be reproduced for the benefit of dwellers in other districts. Either the offer of the Department was overlooked, or some diffidence is felt regarding the ability to put on paper the many valuable lessons which cannot fail to be noted by the intelligent agriculturist. The repetition of the offer will assist in again bringing the matter under notice and, with regard to the latter supposition, the Department will be pleased to assist any would-be contributor in properly presenting to readers any facts regarding crops, cultivation, the effect of manures, fungus or insect pests, &c., likely to be of more than local benefit.

We desire to impress upon our readers the importance of keeping in touch with the Department, and by means of

intelligently acting upon hints thrown out in our scientific articles, to aid its officers in their researches, and thus assist in securing the utmost benefit to be obtained from science practically applied. The *Gazette* will always form a convenient channel for conveying to the agriculturists of the Colony notes of experiments made by any individual farmer, with regard to manures, new crops, remedies for insect or fungus diseases, new implements or methods of cultivation, or any other matter of interest to the general farming community.

The various sections into which the *Gazette* is divided have been well filled, and, by way of addition, the somewhat neglected poultry industry has now been added, the first article having appeared in our November issue. Under this head it is intended to give, in addition to the personal experience of the writer, reliable information, from whatever source, regarding the different varieties of fowls, their laying capabilities and value for the table, advice regarding methods of feeding as well as methods for preventing, and remedies for, various diseases. It is intended, moreover, to confine the information given to the purely commercial aspect of the business, and to avoid more than passing reference to those breeds which are of a fancy character.

A series of articles is now being published which will eventually form a complete handbook to the vineyard and cellar; and other branches will follow in due course.

Before concluding, we desire to acknowledge the courtesy of foreign Departments of Agriculture in so readily exchanging publications, and the compliment paid to this Department by most of the principal papers in Australia in republishing articles from the *Agricultural Gazette*. The bulletins which reach us from all parts of the world are of infinite value, and enable us to give our readers the benefit of their latest

discoveries, side by side with the results obtained in this country. To our readers we desire to convey the congratulations of the Department on the excellent season and the satisfactory reports received regarding their crops. The agricultural outlook was never more hopeful.

Co-operative butter factories are springing up in all parts of the country, and the dairying industry is thereby becoming more stable and more remunerative. There are signs of co-operation with regard to the export of fruit whereby it is hoped that the position of the fruit-growers will be much improved. From an article based upon information obtained from America there is every prospect of an increased demand for Australasian wheat in several markets of the Old World, and the general tendency towards adopting a rational system of rotation of crops cannot fail to have a lastingly beneficial effect as well on the land as upon the farmers in increased returns.

In conclusion, we wish our readers a prosperous year, and again express the hope that they will still further extend the co-operative system by appealing to the Department in all their difficulties, informing it of their successes and generally assisting it to become a centre of usefulness, and thus fulfil the expectations of those who initiated and organised the Department of Agriculture of New South Wales.

Panicum leucophœum, H. B. et K.

"Cotton Grass."

The Grasses of Australia.

(*Continued from Vol. III, page* 949.)

By F. TURNER,
Department of Agriculture.

PANICUM LEUCOPHÆUM, *H. B. et K.* "Cotton Grass."
Flora Austr., Vol. VII, p. 472.

Stems from a branching base 1 foot to 2 feet high. Leaves narrow, long or short, usually glabrous. Panicle of a few long, slender, and erect, spike-like branches, very unequal, and sometimes reduced to two nearly equal ones, or to a single one, the longest 3 to 4 inches, or in some very lax. Queensland specimens 5 inches long; secondary branches short, slender, erect, the lower ones with four or five sessile or pedicellate spikelets, the upper ones with only one or two; spikelets scarcely $1\frac{1}{2}$ lines long, rather acute, densely covered with long, silky, silvery, or purple hairs, often spreading when in fruit. Outer glume scarcely $\frac{1}{4}$ line long, obtuse; second and third glumes nearly equal and empty; both densely hairy; the second usually three-nerved; the third five-nerved. Fruiting glume shorter, smooth, rather acute, and often slightly gibbous at the base. Grain enclosed in the hardened fruiting glume and palea, but free from them.

This perennial grass is found in all the Australian colonies from the coast to the arid interior. It appears to be much more abundant, however, in the latter than in the former portion of the continent. According to Mr. Bentham this species is found also in tropical Africa and America. As might be supposed, a grass that is growing under such varied conditions of soil and climate has developed into many forms. It appears to be most variable in the degree of development of its inflorescence. I have received specimens for identification with panicles composed of seven or eight spike-like branches, others with two branches only, and a few secondary short ones; others again with only a simple spike. The latter specimens belong to the variety *monostachyum*, and are found only, as far as I am aware, in the arid interior. Both the typical form and the variety were collected in West Australia by the recent Elder Exploring Expedition. This grass is easily recognised in pastures when in flower by its spikelets being densely covered with long, silky, silvery, or purple hairs, which give it quite an ornamental appearance. It is generally to be found growing on rich chocolate soils in the interior, and in such situations, in a good season, it will often attain 3 feet in height. In all its varied forms it is a valuable pasture grass, and during an ordinary season it will yield a quantity of rich herbage which is much relished by stock of all kinds. I can recommend it for general pasture, or to be grown and turned into hay. I have had this species under experimental cultivation for several consecutive years, and it proved to be a very prolific grass. When cut as the flower stalks first appeared

it made excellent hay, of which horses were very fond. When the grass is allowed to grow undisturbed for a time it produces a great amount of seed which usually ripens in November and December, but occasionally in the autumn months.

Reference to Plate.—A, showing the arrangement of the spikelets on the rhachis; B, showing the relative size of the outer glume on the spikelet; C, a spikelet opened out, showing the four glumes and palea; D, grain back and front views, all variously magnified.

IMPERATA ARUNDINACEA, *Cyr.* "Blady grass."

Flora Austr., Vol. VII, p. 536.

A STIFF erect perennial, 1 foot to 3 feet high, glabrous, except sometimes a tuft of hairs at the nodes, which, however, is not so common in Australian as in Indian specimens. Leaves erect, narrow, often longer than the stem; spike-like panicle very dense, 3 to 8 inches long, regularly cylindrical, silvery white, with the long silky hairs concealing the glumes, the dark-coloured stigmas and oblong-linear anthers alone protruding. Spikelets 1½ to near 2 lines long; outer glume five or seven nerved, the second three or five nerved, the third usually empty; terminal flowering glume still smaller; palea usually truncate and jagged at the top; grain small, free, enclosed in the outer glumes.

This perennial grass is found in all the Australian colonies, and also in the temperate and tropical regions of the Old World. It is very common in the coastal districts of this country, but I have not observed it growing very far into the interior. It is generally to be found growing on low-lying rich moist land, though I have occasionaly seen it growing on hill sides. In some instances it covers large areas of undrained land, and if the old stems and leaves are burnt off in October or November, the result will be a capital growth of succulent herbage during the greater part of summer, which cattle eat with avidity. As the stems and leaves become old, however, they are very tough and harsh, and when in that condition are seldom or never eaten if other herbage is obtainable. The blady grass has sometimes proved a valuable stand-by for stock during prolonged droughts, especially after being burnt off in spring time. I have known of an instance where a number of sheep and cattle almost depended upon this species alone for forage for a time during a very dry period. It should be a valuable grass to plant for binding the littoral sands, as its underground stems form a perfect net-work, and are most difficult to eradicate. It can also be recommended for planting on railway embankments, the banks of rivers or dams, or on any loose earth, which it would bind, and prevent injury from heavy rains or flood waters. It should never be encouraged near cultivation, however, for once it became established on good land it would prove almost irrepressible; every small joint of its underground stems that is left in the ground is capable of producing a young plant. When the blady grass is in flower it is easily recognised amongst other herbage by its silvery white spike-like panicles. It produces a fair amount of seed, which usually ripens in the autumn months. It is easily propagated by division of its roots.

Reference to Plate.—A, showing the arrangement of the spikelets on the rhachis; B, a spikelet opened out showing the four glumes and palea; C, grain, back and front views, all variously magnified.

Imperata arundinacea, Cyr.

"Blady Grass."

Macadamia ternifolia, F. v. M.

"Australian Nut."

New Commercial Crops for New South Wales.

(Continued from Vol. III, page 858.)

The Cultivation of the "Australian Nut."
(*Macadamia ternifolia*, F.v.M.)

By FRED. TURNER.

The "Australian nut," or, as it is frequently called, the "Queensland nut," is a very ornamental evergreen tree.

In its natural state it is mostly found growing on rich alluvial soils bordering rivers or creeks in the coastal districts of southern Queensland, and in the north-eastern portion of New South Wales. Some years ago I saw the tree growing fairly plentifully in Southern Queensland. At that time it was protected on Crown lands by Government regulations, issued to licensed timber-getters. In its native habitat it attains sometimes a height of 50 feet, with a clean, straight trunk for a considerable height. Rarely, however, does it exceed much more than a foot in diameter. When the tree is brought under cultivation, and is allowed plenty of room to grow, not only will the trunk be furnished with branches nearly to the ground, but it will form a beautiful umbrageous head. Its leaves are arranged in whorls of three or four, and are from 5 to 12 inches long, and bordered with sharp teeth, but sometimes they are entire. The small white flowers are arranged in long racemes, and these are succeeded by nearly spherical fruits, varying slightly in size, but often above an inch in diameter. Each fruit contains one smooth, globular, or two half round, nuts, which enclose a remarkably rich edible kernel, of excellent flavour, resembling, but superior to, the filbert. The nuts, however, are very hard, and it requires some force to break them before the edible portion can be got at. It is probably owing to this circumstance that the tree is not so well and widely known amongst cultivators as it ought to be, considered from an economic point of view. It is difficult to understand, however, the reason why such a beautiful evergreen tree has not been more extensively planted in parks and gardens from an ornamental standpoint, for very few native trees surpass it in the distinctive character of its foliage. Although I have assumed that it is probably on account of its hard-shelled nuts that this valuable tree is not more extensively cultivated in Australia, there is no reason why it should remain unknown to many of our cultivators, more especially in view of the number of superior varieties that have been raised from the typical walnut, filbert, almond, &c., and which are now extensively and profitably cultivated in many countries. From these facts it is only reasonable to suppose that if the Australian nut-tree was brought under systematic cultivation, and a careful selection of seeds made from such trees, varieties might be raised from them

that would produce thinner-shelled nuts than those that are borne on the wild trees. Nature has certainly well protected this tree against extermination in its wild state by providing such a hard covering for the nucleus, but this is not the only tree that is similarly protected in a natural state. If nature had not provided such protection to the nucleus of many trees—the fruits of which we now enjoy—they would, in all probability, have been extinct long ago. The natural enemies of many of them are numerous, not to mention periodical forest fires, which would have destroyed the reproductive powers, for the time being, if they had not been well protected.

There should, at least, be one Australian nut tree grown in every garden and orchard, in suitable places, and where frosts do not occur, in the coastal districts of this Colony, from Jervis Bay to the Tweed, both for the sake of its nuts and for its fine ornamental appearance. It is a capital bee plant, and whilst it is in flower I have seen these industrious insects work at it from early morning till dewy eve. It also yields an excellent timber, which, according to Mr. Bailey, is of a red colour, close-grained, firm, and prettily marked, and will doubtless become a favourite wood with the cabinet-makers. Therefore, on this account, it is well worthy of being extensively grown in forests in suitable localities. At one time the nuts of this tree formed a nutritious article of food for the aborigines, of which they are very fond.

Situation and Soil.

I have seen the Australian nut tree grow best, when under cultivation, in a situation having a north-easterly aspect that was fairly well sheltered from the south-easterly and westerly winds. It seems to adapt itself almost to any kind of soil, provided that it is not too stiff, and is of good depth and naturally well drained. I have seen some very fine specimens that bore abundant crops of nuts, growing in a very light sandy soil, but it was fairly rich in humus. Before the trees are planted the soil should be prepared in a similar way to that for ordinary fruit-trees, and if it is not naturally well drained this should be artificially attended to.

Propagation.

The easiest and also the most natural way to propagate the Australian nut is by sowing its seeds in the autumn or spring. Having successfully raised from seed many of these trees in different ways, I can recommend the following as being about the simplest plan that can be adopted by any one living in the country. From some light deal wood make as many extemporised boxes as there are nuts to plant. Each box should be 1 foot square and 1 foot deep; in the bottom, bore a few holes to allow the superfluous moisture to escape, then put in 1 inch of rather coarse cinders or charcoal to act as drainage, over this place a few partially decayed leaves, then fill up to within 2 inches of the top with a light, free, open soil, press it firmly down, and on the top of this, but in the centre of the box, plant one of the nuts and cover it with ½ an inch of soil. The boxes should then be set on ashes, which will prevent worms getting into the soil, in a situation where the seedlings will have plenty of light, but at the same time be protected from the fierce rays of the mid-day sun. The seedlings must be watered regularly, but with discretion. On no account should the soil be allowed to become soddened with water, or the young plants will soon present a sickly appearance from which it would take them some time to recover. Under ordinary treatment, the seedlings that are raised in this way will be ready for transplanting to their permanent quarters in about

twelve or eighteen months from the time that the nuts were planted. The nuts might be planted where it is intended the trees are to grow permanently, if the young plants could be regularly attended to with water, and kept free from weeds until they became large enough to take care of themselves. If such a plan were decided upon, each young plant should be protected with a small circle of 1 inch mesh wire.

Planting.

This is best done in March or September, after rainfall, if possible, or whilst the soil is in a sufficiently moist but easily worked condition. On no account plant out seedlings that have been growing in pots for a long time, and are in that condition generally known as pot bound; that is, those plants, the roots of which have not had sufficient room to expand, and have wound round each other many times. Such plants rarely give satisfaction, and often remain in a stunted condition for years after planting. Choose only the most vigorous and healthy young seedlings for planting out, and good results will follow. If a number of seedlings have been raised for planting in a particular place, they should, at least, be set out 20 feet apart, so as to allow them plenty of room to develop into fine trees. After they have been carefully planted, each one should be tied firmly to a stake to prevent injury from winds until it becomes well established. If dry weather should ensue after the young plants are set out, they should be watered occasionally until fresh root action takes place, which, under ordinary circumstances, will not be long. A light mulch round each young tree would be an advantage, inasmuch as it would keep the soil cool about its roots, and prevent a too rapid evaporation of moisture from the ground. The cultivation that is required will consist in keeping down the weeds, and the soil stirred occasionally round the young plants. The only pruning that is required will consist in keeping a clean stem for a few feet above the ground, and in cutting back exuberant growths, so that the tree will form a shapely head. A grove of Australian nut-trees would form a splendid feature in the landscape. The age at which the tree comes to a bearing state varies, of course, in different situations. Under ordinary treatment, however, it may be reckoned at about seven years. It is a very prolific bearing tree. I have never counted or measured the quantity of nuts, that a single tree will bear in a year, but I have counted the number that are borne on some of the racemes, and they vary from three to fourteen. The nuts will keep for a considerable time after they are ripe, so that in the event of an over-production for local demands they could be shipped to any distance with perfect safety.

Reference to Plate.—The drawing was made from a photograph of a tree growing in the Sydney Botanic Gardens; A, portion of a raceme; B, a single flower; C, pistil, showing the hypogynous glands; D, perianth laid open showing the four anthers; E, nut; B, C, and D magnified.

Supposed Poisonous Plants.

(Zieria smithii, Andr.) "Stinkwood."

At a recent meeting of the Council of Agriculture of Tasmania, one of the members brought under the notice of the Council certain facts connected with the serious mortality amongst cattle which had occurred in the Scotsdale district. It appears that Mr. Archibald Park, M.R.C.V.S., was despatched by the Government to the locality, and in his report he mentions that a shrub, known locally as "stinkwood," was mentioned to him as being considered fatal to cattle if confined to a certain part; but if allowed to graze on land adjoining no harm resulted. A bough shown to Mr. Park he describes as having a very pungent odour—a peculiar astringent taste, but not sufficient to convince him of its poisonous properties. It appears there are no funds provided for carrying out experiments with cattle, by which they are likely to be destroyed, and Mr. Park was unable to induce any of the farmers to risk two or three head, with a view to ascertaining the effect of feeding them with the shrub in question. The symptoms exhibited by animals supposed to be suffering from the weed, described by Mr. Park, as follows:—Breathing heavy, very much puffed under the skin over the ribs and loins, loud thumping to be heard all over the chest, gurgling in both jugular veins indicating swollen condition of the heart, but owing to the loud noise under the skin, the heart sounds could not be made out; temperature, 99 degrees. Mr. Park, not having an animal upon which to hold a *post mortem*, was unable to assign any cause for the disease, but he made arrangements for Dr. Richardson, of Scottsdale, to do so on the first opportunity. This occurred shortly afterwards, when a beast, with others, got into a bed of stinkwood, and died within a few days. The most important result of this *post mortem* was to enable the authorities to assure the farmers that there was no fear of infection. The cause of the disease, however, is still undecided, and one step in connection with this decision has been taken by sending to this Department a specimen of the shrub known as "stinkwood" for identification by the botanist, who reported as follows:—"The botanical name of the stinkwood-tree, a specimen of which was received from Tasmania, is *Zieria smithii, Andr.* Besides Tasmania, this tall shrub or small tree is found in New South Wales, Queensland, and Victoria, and in some places it is very common. So far as I am aware, it has not hitherto been suspected of poisoning cattle in this Colony. According to Dr. Hooker, *Rutaceæ*, under which order *Zieria* is arranged, owe their stimulating properties to a bitter substance—a resinous acrid principle, and especially to a volatile oil, secreted by the glands of the leaves and flowers. The rue (*Ruta graveolens*) a native of the Mediterranean region, and cultivated in all gardens, is remarkable for its strong smell and acrid taste, and its essence, obtained by distillation, is employed as a sudorific, vermifuge, and

emmenagogue. Vinegar of rue was regarded during many centuries as a certain remedy against the plague. The Romans used rue as a condiment, as do the Germans still. *Ruta montana*, which grows in Spain, is so extremely acrid that it produces erysipelas and ulcerous pustules on the skin of those who gather it. *Haplophyllum tuberculatum* is so much less acrid that the Egyptian women bruise its leaves in water, and use it as a hair-wash. The peduncles and flowers of the European Dittany (*Dictamnus albus*) are laden with pedicelled glands, which secrete an abundant volatile oil so copiously that the plant ignites at the approach of a candle; its resinous scented and bitter root is tonic and stimulating. *Peganum Harmala* grows in sandy soil in the Mediterranean region; its smell is repulsive and its taste acrid and bitter; the Turks use its seeds as a condiment, and obtain a red dye from them."

Homeria aurantiaca, Sw.; *H. collina*, Thunb.

A specimen of the weed, which is reported to have caused many fatalities amongst stock, has been forwarded from Echuca, and handed by the Chief Inspector of Stock to the Department of Agriculture for identification.

In his report thereon, Mr. Turner says:—"By the receipt of a more complete specimen of the supposed poisonous plant, I have been enabled to obtain a more complete diagnosis, which, however, fully confirms my previous observations. It is an Iridaceous plant, and is known to scientists as *Homeria aurantiaca*. It is a native of South Africa, but has long been cultivated in Australian gardens, as also has another species, *Homeria collina*. Several exotic Iridaceous plants have escaped from cultivation, and now are apparently wild in some parts of New South Wales (*vide* my list of introduced plants). With regard to the properties of these plants, Dr. Hooker says:—'The tuberous or bulbous rhizomes of *Irideæ* contain a small proportion of a fatty and acrid matter and a large quantity of starch, combined with a peculiar volatile oil, which gives them stimulating properties. Some species lose their acridity by drying or boiling, and their tubers may be used as emolients, or even as food; such are several South African species which are eaten by the Hottentots. The bulbs of *Moræa collina* (syn. *Homeria collina*), of the Cape, are very poisonous, and have the same effect as fungi.'"

Medicinal Plants.

By T. PHILLIPS-GIBSON,
Department of Agriculture.

"Whiles yet the dew's on ground, gather these flowers,
. . . . "Who has the note of them."

Cymbeline, Act I, scene 6.

THE cultivation of plants and herbs has always occupied a considerable portion of man's time and attention. Ever since that fatal day when the first man was expelled from the garden planted by the Creator, and condemned to earn his bread by the sweat of his face, it has been necessary to cultivate and propagate the plants used for food, and at the same time to devote some thought to those possessing properties having the power to assuage the ills and troubles entailed upon the human race by that same act of disobedience.

Happily, it has been ordained that the earth should bring forth abundantly the "herb yielding seed," for it is impossible to imagine what the appearance of this world would be without the clothing of plant-life which now covers it. If the powers of vegetation were suddenly suspended, the animals, and finally man, would be deprived of the means of sustenance, and, in a short time, existence would be impossible, life would become extinct, and earth would be a useless cypher in the great scheme of creation, a death-ship on the eternal ocean of space; but, fortunately, such an event is not within the range of probability, and while the earth responds liberally to the efforts of the cultivator, it also produces freely many plants the nature and the uses of which have yet to be determined.

Among some of the most useful of the vegetable productions are those which are applied to medicine, and it is noteworthy that they are of very wide dispersion. While not going so far as some physicians and botanists, who assert that where nature produces diseases she also produces the remedies for them, it may be pointed out that scurvy grass and other plants of a like nature grow in cold climates, where scurvy is epidemic; the hot spices in climates where the stomach is liable to torpor from the heat; and that sarsaparilla and cinchona are natives of South America, where impure blood and fevers are almost conditions of existence in the humid valleys.

A number of native Australasian plants must possess medicinal qualities as yet unknown, except perhaps to the aboriginals, but this can only be determined by careful observation and experiment; in the meanwhile there should be cultivated in these colonies such plants as are of proved medical value, and which, although not indigenous, may be grown successfully. It shall be the object of the short articles which will appear under this heading from time to time to give some particulars of these plants (taking the British Pharmacopœia as the standard) that may be so grown, giving directions for their culture and preparation for the manufacturing druggist, and, where advisable, simple instructions for preparing them, together with the quantities forming a dose for domestic use, as well as such notes on their

history and literature as will make them interesting to the reader, and at the same time instructive to the grower.

It must, however, be remembered that a great number of the plants used in pharmacy are very common in their native countries, in some places being only weeds, and some discrimination must be shown in cultivating them, but Burbridge says, "There are few who fully comprehend the fact that every species is wild in some particular portion of the earth's surface"; and there are few farms where there is not some out-of-the-way spot that may with advantage be devoted to herb-culture, and with increased knowledge of their habits and requirements, with confidence in the value of the product, a trade in crude drugs may be opened up. A large selection of subjects is at the choice of the experimenter who desires to give attention to this, as yet, unopened field of production; and there is no reason why New South Wales should not supply the perfumer with violets, lavender, or rose-water, and the druggist with jalap, aconite, and rhubarb, as well as Europe or America; besides, the labour is usually very light, and may be allotted to the younger members of a family, while, at the same time, it is of great interest to all engaged in the culture, and should lead to an intelligent study of native plants and their qualities. By this means plants at present neglected would become of commercial importance (for research is continually adding new drugs and preparations to those already known), and what are now considered useless weeds may yet become subjects of careful cultivation; therefore,

> "Think not nature's scheme sublime,
> These humble things might spare;
> For science may detect in time
> A thousand virtues there."

DANDELION (*Taraxacum officinale*, Wigg).

THIS plant is a native of the Northern Hemisphere, extending over Europe, Asia, and America, in a wild state, and is in many places a common weed. It is, however, cultivated in some parts both for medicine and culinary use. It has been introduced and succeeds well in many parts of Australia.

Though it is a plant which must have been well known to the ancients, no distinct reference to it can be traced, either in the classics of Greece or Italy, although a plant mentioned by Theophrastus is thought to be it. The word Taraxacum is usually considered to be of Oriental origin, probably meaning "wild lettuce," and we first meet with it in the works of Arabian physicians, who regarded it as a sort of wild endive. It is thus mentioned by Rhazes in the Tenth and by Avicenna in the Eleventh Century. Some commentators consider it to be one of the bitter herbs eaten with the Passover lamb by the Israelites when leaving Egypt.

Dandelion is also known to botanists as *T. dens-leonis* and *Leontodon taraxacum*. These names have reference to the lion, some thinking that the yellow petals of the flowers have a similarity to the golden teeth of the heraldic lion, and others having the opinion that the edges of the leaves or the whiteness of the root led to the name being bestowed by their bearing a likeness to the lion's teeth. However this may be, the common English name "dandelion" (which occurs in some form or other in all European languages) is but a corruption of the French *dent de lion*. One author points out that the lion, in mythology, is the representative of the sun, and the dandelion is essentially a sun plant, while the appearance of the flower is very suggestive of the ancient pictures of the sun, and at the present day

in Denmark, Germany, and Switzerland the children are in the habit of making a chain of dandelion flowers and dancing in a circle, singing a nursery song in praise of the summer sun. This name, referring to the lion's teeth, has been applied to the plant very early, it being noted as a remedy for liver complaint by Welsh physicians, as *Dant y Llew*, in the Thirteenth Century.

Dandelion is very easily cultivated—indeed, when once established, may become troublesome, and therefore care should be exercised as to the situation in which it is planted. It is not particular as to soil, and any remote corner will do admirably to form the beds. The easiest mode of propagating is by seeds, but the roots may also be divided, and a very little portion will suffice to form a new plant. It is, however, in England, usually self-sown, and Cooke, in "Freaks and Marvels of Plant-Life," page 297, remarks:—"The stalks of the down in the dandelion contract closely together in moist and wet weather—a beautiful provision to secure its dispersion only on a dry day, when it is driven off by every zephyr, and not unoften by the schoolboy, who thus endeavours to resolve his doubts as to the hour:

> "Dandelion with globe of down,
> The schoolboy's clock in every town,
> Which the truant puffs amain,
> To conjure lost hours back again."

There are several preparations of dandelion used in medicine, the British Pharmacopœia recognising a decoction, extracts from both the fresh and the dried roots, as well as an extract of the juice in spirit. The decoction is made by boiling 1 oz. of the root in a covered vessel, and, after being strained, the liquid made up to a pint by adding more water; the dose being two to four tablespoonfuls. The extract is more difficult to prepare. It is made as follows:—The fresh root is bruised, and the juice allowed to settle; the liquid is then heated to 212° F., this heat maintained for ten minutes, and the extract afterwards evaporated till it is thick enough to be made into the pills. A good preparation for domestic use is made with 4 oz. of the fresh roots in $1\frac{1}{2}$ pints of water, and boiling down to 1 pint, and then straining. This can be taken one or two tablespoonfuls two or three times daily.—*Cooley's Practical Receipts.*

The value of dandelion as a medicine depends upon the bitter principle—*taraxacin.* It is a mild laxative medicine, acting specially on the liver; it is also used in dropsy, and is given along with purgatives. It is a very useful tonic, and prescribed in biliary disorders and dyspepsia.

The root is considered to be in the best condition for use in early winter, the juice at that period giving a larger and better product than at any other, but some prefer that which is gathered in spring.

When the root is being collected for sale, the plants are taken from the ground entirely, and after being freed from earth are dried in the sun; it is then of a dark-brown or blackish colour, breaking off sharply, the broken part showing a yellowish centre surrounded by a whitish bark; on the outside it is more or less shrivelled, with deep furrows lengthwise.

The roots are long, tapering, and seldom branched, and grow in good soil to the length of a foot or more, with a diameter of from an inch to an inch and a half. When dried they are packed in boxes or bales, the size of the package, of course, depending on the quantity in hand, and it is then ready for sale. A good demand for properly-dried roots, free from earth and any foreign substances, always exists, and considering the little trouble of cultivation and harvesting, the price obtained may almost be looked upon as clear profit.

Dandelion is also used on the Continent of Europe as a salad, both the fresh roots and the leaves being used; for this purpose the plants are grown in drills, and blanched in the same way as celery or sea-kale. When used in this manner they are an agreeable and wholesale addition to the salad, and make a good appetiser. The roots are also used in some parts of England, Germany, and America as a substitute for coffee. A well-known preparation is "dandelion coffee," being a mixture of the roots ground with the genuine coffee-berries. The flowers are also capital for honey, being in this respect great favourites of the bees, several of the bee-keepers who reported on honey-plants in the beginning of last year mentioning them as producing good honey of excellent quality.

This notice may well be closed by remarking that the dandelion has been called the "rustic oracle," in reference to the custom of lovers testing the faithfulness of their sweethearts by blowing the downy seeds, and its habit of expanding its rays with the sunrise and closing up in the evening has earned for it the name of "Shepherd's Clock." Darwin says:

> "Leontodons unfold
> On the swart turf their ray-encircled gold,
> With Sol's expanding beam the flowers unclose,
> And rising Hesper lights them to repose."

SQUILL (*Urginea scilla*, Steinh.)

THE name squill is applied by gardeners to several species of *Scilla*, but the medicinal squill is the product of *Urginea scilla*, Steinh. (*Scilla maritima* Linn.) It is a native of the countries on the Mediterranean coast, both Europe and Africa, and extends from the sea-level to a height of 3,000 feet. It is very common in the south of France, and occurs also in Spain and Portugal. In the neighbourhood of Genoa the peasants like to see it growing under the fig-trees.

Squills have been used in medicine from a very early period. The ancient Greek physicians prescribed it with vinegar and honey in almost the same manner as it is now used. Epimenides, who lived in the 30th Olympiad, is said to have used it extensively, and it is mentioned by Theophrastus. Pliny, who was acquainted with the two varieties (red and white), says, in his Natural History (Lib. XIX, cap. 30), that Pythagoras wrote a volume on its medicinal virtues; and Dioscorides describes the method of making the vinegar of squills which, as well as the syrup, was known to the ancient Arabian physicians. In Egypt it was consecrated to the god Typhon, and mummies of Egyptian women have been found with a squill in the hand. They also planted it in groves, and hung their houses with it to preserve them from evil spirits. In Arcadia, at the festival of Pan, the statue of that deity was decorated with the flowers and the roots of this plant.

The squill was first cultivated in England, for medicinal purposes, in 1648, in the Oxford botanic garden, and it has since been retained in one or other of the different pharmacopœias of the United Kingdom, until the publication of that known as the British, when it was retained as officinal.

The plant belongs to the natural order of the *Liliaceæ*, and is closely allied to the onion and garlic; there are two varieties recognised, viz., the red and white, the white being considered the better. The part which is used is the root, a large, roundish, ovate bulb, of a white or pale-yellowish colour. The most common, and by far the most simple, method of propagation is by offsets, and few bulbs increase or multiply more rapidly; but it is important, in order to be successful, that the division of the bulbs should be effected

when the plants are quite at rest. They should be lifted when the leaves have died down, and the mass carefully divided, and then replanted as soon as possible. Almost any soil will suit, but they succeed best in a light, rich, sandy soil; they grow well in sandy loam, but still faster and of a larger size in a soil composed of peat or mould and sand. A sheltered and partially-shaded situation is to be preferred, as it will not become dry so soon as a more exposed position. As the bulbs do not stand storing well, in order to commence a plantation it may be necessary to obtain seed, but as the seeds are numerous, one or two plants allowed to flower and perfect their seed will be sufficient for ordinary purposes. The seed should be sown, rather thinly, in a well-prepared seed-bed, or else in pans, and covered with about an inch of fine earth. At the end of the first season's growth the bulblets may be taken up and planted in their permanent position, at distances of 1 to 1½ feet apart. It is now only necessary to keep them clear of weeds for the next two years, when they will be ready for lifting and preparing for sale.

In Europe the bulbs are gathered in the month of August, corresponding with February or March in Australia; and are at once freed from their outer dry scales; they are then cut transversely into slices and dried in the sun. Prepared in this manner, the drug appears in the form of narrow, flattish, almost four-sided curved strips from 1 to 2 inches long by three-eighths of an inch or so wide. They are, when moist, flexible, partly transparent, and of a pale yellowish colour; or, if prepared from the red variety, of a roseate hue. When thoroughly dry they become brittle, and are easily powdered. The dry slices are now packed in convenient-sized boxes, and forwarded to the brokers or agents for sale. The bulk of the drug used in England is obtained from Malta, and is prepared as above; while from some other parts packages are shipped consisting of the whole bulb packed in sand.

Both varieties abound in an acrid juice, and have a very bitter taste. They owe their medicinal value to the principles named *Scillitoxin* and *Scillin*. Squills are used as an emetic in whooping-cough, croup, and chronic pulmonary affections, such as catarrh, asthma, &c., and also as an expectorant. There are seven preparations recognised in the British Pharmacopœia, but with the exception of the vinegar and the syrup, they require careful manipulation, and should not be attempted by any but the trained druggist or dispenser. To make vinegar of squills, 2½ oz. of the sliced root is macerated in one pint of dilute acetic acid or in distilled vinegar for seven days, then strained, and 1½ oz. of proof spirit added to make it keep. If, by the aid of a little heat, 2½ lb. of refined sugar is dissolved in one pint of this vinegar of squills, the preparation is called syrup of squill. (B.P.). This latter is a favourite remedy for children suffering from croup, the dose being a small teaspoonful at intervals until vomiting is brought on, thus removing the phlegm.—(Thompson's "Domestic Medicine.") The vinegar of squill is also mixed with honey in the proportion of one pint to 2 lb. of honey, and is useful for the same purposes, but in smaller doses.

Other species of *Urginea* are *U. altissima*, a native of South Africa, which is closely related, has similar properties, and is used by the settlers of that colony for the same purpose as *U. scilla*, and *U. indica (Scilla indica*, Roxb.), a very widely-diffused plant, occurs in India, Abyssinia, and Nubia, used by the Arabs and Hindoos for similar purposes. Another plant, *Crinum toxicarium*, Roxb., is cultivated in Indian gardens, and has been admitted into the Pharmacopœia of India as an emetic. It has handsome white flowers and fine foliage, growing wild in many parts of both India and Ceylon.

The Western Districts.

By BRUCE SUTTOR,
Department of Agriculture.

On a recent tour through the Western Districts I first visited the Bathurst Plains, which enjoy exceptional advantages in respect to facilities for agricultural operations, having rich alluvial flats and uplands, the cultivation of which is mainly confined to lucerne and cereals. Many of the wheat crops I saw in September were looking remarkably well, though in some cases, from continuous cropping of wheat, old and exhausted fields were easily discernible, but in a few instances I found farmers desirous of gaining information as to the application of suitable manures. The high cost of freight to this and other western districts remote from the manufacturing centres greatly deters the introduction of artificial manures. Nitrogen being a valuable fertiliser for wheat, the soil may be renovated by growing leguminous crops which contain this essential constituent, such as lucerne, clovers, peas, &c., and ploughing the whole crop into the land. Mr. Warboys, of Spring Hill, has adopted this plan with a small area of peas, with the result that the succeeding crop of wheat had a superior appearance to those surrounding it. Where leguminous crops will grow, this system of enriching the land may be resorted to with great advantage. It is always desirable to grow a rotation of crops, and shallow-rooted crops should be alternated with deeply-rooted ones, and by this means the same ingredients are not being continuously drawn from the same regions of the soil. Exhaustion is thus deferred, the yields are larger, and the crops, having vigorous growth, are better able to resist the attacks of insect and fungoid pests. The variation deprives the insects living on any particular crop of their food, and when that crop is moved they lose their sustenance, and either die or go elsewhere.

In the Orange and surrounding districts farming operations are carried on evidently with a view to profit, and many intelligent farmers are to be found systematically working their holdings to the best advantage. Bare fallowing is largely practised with beneficial results.

The expense and trouble of clearing timber off the land is an obstacle to some of the farmers increasing their area of arable land, though, notwithstanding the cost, it pays to make more land available for the plough, especially where there is no system of manuring. The increased yield per acre from the new land will shortly recoup their outlay, and the old fields may be laid fallow, or sheep may be allowed ts graze on them. The custom of making log-fences of the waste timber from an economic point of view may not in the first instance be objected to, though it is generally recognised that such fences harbour no end of insect pests, to say nothing of reptiles, vermin, and the space they occupy. These unsightly fences are occasionally being replaced by posts and wire and hedges, which latter fence greatly improves the appearance of the farms, and the rotten wood and ashes of the old logs afford good manure. The best kinds of hedges I have seen tried here are the hawthorn and osage-orange, both of which appear to thrive.

In recommending live fences, it may be contended by some that they injure the adjoining crops by exhausting the soil; but the fact is that the shelter they afford fully compensates for their keep.

Wellington, being 848 feet lower than Orange, there is a decided change of climate there. All the corn crops looked much more forward than at the latter place, and so great headway had they made, owing to the exceptionally favourable season, that farmers were apprehensive of their falling before coming to maturity, should adverse weather come meantime. The district is admirably adapted for dairying, and a butter factory of small dimensions is already in existence, with a separator, doing good work, and is, I understand, being profitably conducted, though the milk is said to be of poor quality, which is obvious from the fact of the cows being obliged to suckle their calves, which practice will no doubt be discontinued as the operations become more extensive.

Both climate and soil are well suited for growing fruit-trees and grape-vines, and their cultivation should be encouraged. Mr. B. J. Curston is extensively experimenting in this direction on a recently-acquired piece of land, he having secured a large number of the best varieties of fruit-trees and vines from California, and he entertains the idea of irrigation. Fig-trees do remarkably well, and are very prolific. One gentleman informed me that his fig-trees last year returned a profit of about £3 per tree. Marshmallow grows rank in this district, and it is alleged to injuriously affect horses grazing on it, inasmuch that when the animals are driven fast they readily perspire, stagger, and, in some cases, fall down. This property of the plant is, however, questioned by some authorities, as it is understood that in some parts of America the tall marshmallow (*Malva sylvestris*, Linn.), resembling that which is growing at Wellington, is recommended for silage, and the matter is being investigated with the view of gaining more accurate information.

Dubbo was in a very flooded state when I reached there, and I consequently made my visit a short one. Mr. J. Penzer, of Yarrandale, whom I visited, expressed himself entirely satisfied with his experiment last year in making silage of the variegated thistle, without applying pressure. The method adopted in building a stack of 300 tons was by raising it from day to day with from 15 tons to 20 tons of the green material, the idea being that the weight of one day's carting would be sufficient pressure for the preceding days, and so on. Though it was reckoned that when the stack would be used that at least 2 yards deep on the top would be lost or of no value, it was gratifying to find, when cutting it, there was only 2 feet deep of waste under the corrugated-iron covering, and on the outsides there was a small proportion only of mouldy stuff. The thistles were cut when in bloom, and the silage turned out sweet and first-rate fodder, and was the colour of tobacco. The milch-cows, to which stock it was mainly fed, ate it readily, were said to thrive on it, to increase their supplies of milk, and to prefer the silage to anything else within their reach. A feature of this stack was that it shifted slightly from where it was erected, and a large stream of dark liquor escaped from it. The quality of silage is directly dependent on the material from which it is made; and it must be borne in mind that the process of ensilage will not give higher feeding value to any coarse and innutritious substances that may be employed, though it possibly may make them more palatable to stock.

The variegated thistle contains many valuable food constituents, especially salt. It is easily obtainable, and grows abundantly in many parts, and though it has often been looked upon as a troublesome weed, it may, if

converted into silage, be turned to profitable account, and large quantities might, with very great advantage, be stacked up for times of scarcity. As thistles possess an excessive quantity of juicy matter, it may be advisable, when building a stack, to put alternate layers of straw on it, to absorb the valuable elements which would otherwise be lost, though this system may require additional pressure.

As some of the residents of Cobar are desirous of gaining information as to the suitability of their soil and climate for growing wheat and other agricultural products, I proceeded thither with a view of advising on the subject. There are certainly difficulties to be contended with, and the greatest appears to be the low average rainfall, as seen from the subjoined record :—

	Rain.	Wet days.		Rain.	Wet days.
1881, May to December...	9·25	26	1887, May to December...	14·94	35
1882 „ ...	13·95	52	1888 „ ...	4·36	10
1883 „ ...	7·24	38	1889 „ ...	21·17	47
1884 „ ...	7·22	40	1890 „ ...	28·43	71
1885 „ ...	15·83	39	1891 „ ...	31·48	66
1886 „ ...	20·76	51	1892, to September ...	6·48	26

Accompanied by the Rev. P. Power, who takes a lively interest in his district, and who has evidently studied its surroundings, I drove several miles from Cobar, but we mainly confined ourselves to the Reserve, or what is known as the Common, comprising, I understand, 94 square miles. The whole district had a decidedly bare appearance, caused by the prevailing dry weather and the depredations of rabbits, which, however, have now almost disappeared through starvation. I found a few small areas of wheat growing, which, though having a thin and rather stunted appearance, had a remarkably healthy colour. The indifferent manner in which the soil was prepared would, in a great measure, account for the poor growth, as in such dry climates especially good crops can never be expected unless the soil is deeply ploughed and well tilled, whereby the roots are allowed to spread in search of food, and by capillary action the moisture rises and helps to sustain the crop.

Very little cultivation has, as yet, been carried on in the Cobar district. I heard of 17 acres of lucerne having been grown, which in the year 1887 was said to have been cut five times, yielding 4 tons per acre at each cutting, which was the result of 20 lbs. of seed sown per acre. No wheat has been threshed, though what has been grown was estimated to yield 25 bushels per acre. A witness brought up in a farming district in South Australia affirmed that he had never seen a better yielding crop in that colony than Mr. O'Neill's 13 acres of wheat of last year, from which 20 tons of chaff were cut.

The alluvial flats now covered with dense "yarran" scrub are decidedly the best of the land, the soil of which is chocolate-coloured clay loam, about 6 inches to 8 inches deep; the subsoil being clayey gravel. I obtained from Mr. Sydney Walker's Oxted farm, of 640 acres, a sample of soil for analysis, typical of the yarran flat country. Mr. Walker's farm is like an oasis in the desert, and it was pleasing to find there a neatly kept orchard and vegetable garden, where everything then growing looked healthy and free from disease, such as apples, apricots, mulberries, figs, and peach trees, all of which are said to bear well, and the latter remarkably so. It appears to be generally considered that the present nakedness of the land is not wholly due to the want of rain, but also to the rabbit pest. As these rodents apparently have so continuously devoured every vestige of grass on presenting itself, that there can be now but very little seed left to germinate. The extermination of this pest is looked upon as hopeless, and the only means of in any way coping with it is by subdividing holdings into small areas with rabbit-proof fences; the system of making large divisions proves

to be of little or no avail. Notwithstanding the many difficulties in connection with droughts and rabbits, the enterprising residents have still unbounded faith in their district, and a number of the leading men are desirous of forming themselves into a syndicate for the purpose of experimenting with wheat-growing on a somewhat extended scale, and of inducing settlement, and are desirous of acquiring a considerable area to promote the operation. Unfortunately, there is no land in the immediate vicinity of the township at present available, except a special area on the common, the price of which is, I understand, from 30s. to £3 per acre, which is looked upon as too high for such a venture, seeing that the district is so far distant from markets and from any main centre.

From 500 acres to 1,000 acres has been mentioned as the intended area for putting under crop, and advice has been asked as to the probable cost of machinery and plant for working such a farm. Generally speaking, the amount may be estimated at about £1,300, which would include 8 horse-power engine, threshing machine, two reapers and binders, and all other necessary implements, except a steam plough, besides which a manager's house, cottage, barn, stable, and sheds, fencing and gates, tanks, &c., would also be required. As the cost of freight varies it has not been included in the above.

Wheat may undoubtedly be grown by proper cultivation much more successfully than as at present, but the only true test is practical experience, and it may be advisable for those willing to make the trial to first experiment with good cultivation on a small area of from (say) 50 acres to 100 acres, and, at the same time, other agricultural products may be tried. I am inclined to believe that grape-vines, with proper attention, may do well, and the varieties of fruit-trees already proved to thrive should certainly not be neglected. A visit to Messrs. Bragg Bros.' station, near Narramine, amply demonstrates what good farming will do for wheat crops in that district. Some 300 acres are under crop, which looks splendid, and at present gives promise of an abundant return. An experimental wheat crop is specially well prepared, and has a healthy appearance, as also a small plot of malting barley, which latter can be recommended as an alternative crop with wheat.

Messrs. Bragg wisely took the precaution of making their boundary fence rabbit-proof before that pest made its appearance.

Farming operations to be successful cannot now be carried on in the same perfunctory manner as in former times, when there was less competition and transit was more difficult, and it is gratifying to find in some instances farmers are now becoming more desirous of first hearing what science has to say about agriculture. A farmer must of necessity know the nature of his soils and the agencies required for replenishing them—he should allow himself sometime for study and for a proper system of book-keeping to show the state of his affairs. Inadequate labour on a farm is false economy, as in consequence nothing is done in season. Crops are not sown at the proper time, plants requiring any special attention are neglected, pests are allowed to run rife throughout the orchard. The house is unprovided with vegetables, fences are not kept in repair, the stock break into the crops, the cows have to be milked, and many other such minor matters occupy the attention of the already overworked proprietor. A sudden rise in the price of stock or produce cannot be taken advantage of, and the main chance is lost. The whole business of the farm thus goes on from year to year in an unsatisfactory and muddled state. Those farmers feeling themselves behind the times would do well to look over the fences of their more enlightened neighbours.

Rainfall, Cobar.

	1881.		1882.		1883.		1884.		1885.		1886.		1887.		1888.		1889.		1890.		1891.		1892.	
January	...	...	1	·10	2	·36	...	...	9	5·30	3	2·06	2	1·35	1	·26	2	·80	6	3·34	7	9·43	1	·05
February	...	...	4	·83	4	·84	4	·36	4	·98	...	...	5	2·37	2	·55	1	1·47	9	6·71	1	·98	2	·52
March	...	...	1	·58	3	·27	2	·18	1	1·40	...	...	7	2·71	...	...	1	·18	7	3·30	7	2·02	2	1·00
April	...	...	4	1·28	2	·32	3	·49	1	·95	2	·50	1	1·92	...	...	5	5·90	6	2·47	4	3·39	...	...
May...	5	2·40	5	1·98	7	1·82	5	1·02	4	·66	5	2·67	1	·20	2	2·08	2	1·34	8	2·14	3	2·57	5	1·52
June	6	·81	7	·97	3	·36	4	1·81	4	·92	1	·25	4	·53	...	...	5	2·81	9	3·01	12	1·62	3	·59
July...	1	·03	4	·22	2	·01	1	·43	1	·10	11	2·48	4	1·23	...	...	3	·31	5	1·82	5	·94	3	1·09
August	3	·47	9	1·72	5	·59	2	·26	2	·34	11	4·50	4	2·33	...	...	10	1·85	5	1·05	10	3·18	4	·47
September	2	1·30	1	·07	1	·02	7	·99	1	·42	3	·48	...	...	...	...	4	·62	6	2·28	6	1·34	4	1·24
October	2	·63	10	3·29	4	2·06	6	·53	2	·26	4	1·39	1	·15	...	...	7	1·89	2	·76	3	1·00	...	...
November	5	3·62	4	1·94	4	·51	5	·82	2	·19	5	1·71	1	·55	1	·18	5	2·54	5	1·18	3	2·29	...	...
December	2	·19	3	·97	1	·05	1	·33	5	3·19	6	4·72	5	1·81	4	1·29	2	1·46	3	·37	5	2·62	...	...
	26	9·25	53	13·95	38	7·24	10	7·22	39	15·83	51	20·76	35	14·94	10	4·36	47	21·17	71	28·43	66	31·48	...	...

Clearing Land in the Western and Southern Plains Districts by the aid of a Team of Bullocks.

THE usual and best method of treating forest land intended for cultivation in these districts is to ringbark the timber about ten years previous to clearing. This process tends to aerate and sweeten the soil, thereby increasing its productiveness.

Another great advantage, if time is not a desideratum, is in the cost of clearing, which amounts to about the same for 5 or 6 acres of dead timber as for 1 acre of green timber. The dead tress require very little if any opening round the roots previous to being pulled down, especially if the work is done in winter when the land is moist. The dead trees burn easily, there are no tops to cut, and few roots within the reach of the plough to be removed.

There is the disadvantage, however, that the fencing timber is destroyed, but in many districts there are still reasonable facilities for obtaining fencing materials.

In commencing operations, if green timber is to be cleared from the land, mark a straight strip, 1 chain wide, through the site to be cleared. Open out the soil halfway round the trees, and about 3½ to 4 feet away from the trunk (a greater distance if the timber is very large), and of sufficient depth to enable all the exposed roots to 'be cut, working well under the stump to allow the tap-root to be cut through.

The excavations to be made from side to side of the marked strip of land, so that the trees when hauled down will fall lengthwise with the strip.

When this is completed, repeat the operation on another strip of land of equal width to No. 1, taking care this time to make the excavations on the opposite side of the trees, and so on through the whole block to be cleared.

In digging out the soil, the top spit requires to be placed back about 3 feet from the outside of the opening, the second spit next to it inside, and the under soil on the top of these. When filling in the holes, the under soil goes back first, and the top or the best soil is replaced on the surface again. If the subsoil were allowed in the refilling of holes to take the place of the surface soil it would take a long time to sweeten and become productive.

When the trees are pulled over, the uncut roots at the back are generally brought completely out of the soil, or, if not quite exposed, the soil is disturbed and indicates where the roots require removing from the reach of the plough before the cultivation commences. Another advantage is that the butts of the trees when felled are lodged over the holes, and the earth sticking in the roots can easily be picked out and falls into the cavity below it, thereby saving the labour of having, as by other methods, to move that portion of the soil twice.

Tackle required.

1. A 2-inch best steel wire rope, from 90 to 100 feet in length, with a swivel, three links, and a hook attached on each end of the rope, made very stout and strong, to be able to bear a good strain.

2. A close-linked stout chain of suitable length for a sling provided with a strong ring in each end link; one ring small enough to pass through the other. A straight barrel of a tree, about equal to the drawing power of two pairs of bullocks, provided with strong chains round the butt ends, one to hook to the bullock team, and the other to hook on to the wire rope, which is in turn hooked with the sling placed round the standing tree.

3. A light, strong ladder of about 20 feet, to carry the sling up to the required height, completes the outfit.

Pulling down the Trees.

A team of six to eight pairs of bullocks—heavy, strong beasts—are required, according to the size of the trees to be felled.

In commencing operations carry up the chain-sling, and place it round the tree stem, passing the small ring through the large one, and haul up tight. Hook one end of the wire rope into the small ring on the sling, and the other end to the log previously mentioned, to which the bullocks are attached. The higher up the tree the sling is placed the greater the leverage and the easier the tree comes down.

Start the team pulling at right angles to the openings in the ground. When the bullocks pull, the log is slung up from the ground, and keeps the standing tree from springing back into its original position if a second pull is required to bring it down, which is a very great advantage with heavy trees of sound growing timber and strong roots. By these methods the heaviest and largest trees of these districts come down without much trouble. Ordinary ones of from 24 to 30 inches in diameter usually fall at the first pull.

When the tree is falling, stop the team at once, or the hook in the wire rope will be drawn tight into the ring of the sling, and there will be difficulty in releasing it.

I would here mention that, in pulling down dead trees, the log may be dispensed with if the wire rope is of sufficient length to prevent the hindermost pair of bullocks from choking down by being lifted from the ground when the team is pulling.

Take in turn the trees to the left hand and to the right hand, driving the team up the centre until the end of the strip is reached, then turn the team and pull down the trees in the opposite direction on the next strip of prepared land. By this method unnecessary turning is avoided, which is an item if a team of eight or more pairs of oxen are used.

Stump Extraction.

Dead stumps require opening up in the same manner as trees. Green stumps require opening all the way round, as they are firmer in the ground, and only a small leverage is obtainable.

Place a strong chain round the stump, as near to the top as possible without allowing it to slip, pass it through the large ring and over the top of the stump. By this method you obtain all the leverage possible.

Hook the team as close to the stump as possible, giving them more lifting power, and the stumps are generally dislodged first pull.

The Sereh Cane Disease.*

By Dr. G. KOTTMAN,
Inspecting Chemist of the Colonial Sugar Refining Company.

The disease of the cane called sereh is known to have existed in Java for only a few years. It is said by some that it was first discovered in 1879 in the Cheribon district in Western Java, while others contend that it was recognised as a well defined disease only in 1883 in the same district. Possibly its real origin has to be dated back further even than 1879, as it is a disease which in its first stages does not develop any very marked outward signs, and so may have only had attention drawn to its existence when it had taken hold of the cane to such an extent that the crops fell off considerably.

The outward signs of the sereh are side-shoots springing from the cane, and a tendency to the formation of roots on the stalk, and also to the development of more leaf than stalk. The latter is the most characteristic of all signs. When the cane gets very badly diseased the leaves are set much closer together than is the case with sound cane, and in the last stage of the disease the cane forms almost nothing but leaves and no stalk; the stool then has much the appearance of a herbage known in Java as *Sereh*. Thus the disease got its name. Other characteristics are red streaks in the interior of the cane on being split open, the cane becoming rapidly over-ripe, and the dry leaves being more brittle than those of sound cane. When the sereh has fairly got hold of the cane the crops fall off considerably, and the ratoons, as well as the field planted with diseased cane, show, as a rule, a still more serious decrease in the yield.

It is not at all an easy matter to decide in the early stages as to whether cane is attacked by sereh or not. The disease begins to show itself by outward indications only after the cane is well over ground. But even then stalks infected with the disease may attain nearly normal development.

In order to illustrate the difficulties in the way of discerning sound and diseased cane, I may mention that Mr. Kobus, the botanist of the Eastern Java trial station, who has repeatedly travelled over the sugar districts of Java under special instructions to collect information on the disease, and who should therefore be well acquainted with its outward signs, says in the July number, 1890, of the Java agricultural paper *De Landbouwer*:—"With our want of knowledge as to the nature of the sereh, and of distinct outward signs of the disease, it was sometimes difficult to say if a plant was attacked by sereh or not." Dr. Benecke, the head of the trial station of Middle Java, in the November number, 1890, of the same paper, is reported to have said, when asked about the cane obtained in a certain experiment, that he would

* In consenting to the republication of this article Dr. Kottmann expresses the decided opinion that the disorders showing amongst cane on the Northern rivers are not "sereh."

not give an opinion on the question as to whether the cane was healthy or diseased, as neither the cause nor the symptoms of the sereh are yet known

I may remark that if a cane develops some of the exterior indications of the first stages of the sereh disease, as, for instance, the growth of many side shoots or red streaks in the cane, it is not proved thereby that the cane is attacked by the sereh, as cane interfered with in its development in different ways may show the same signs. If, however, cane were to develop many side shoots and closely set leaves at the expense of the formation of stalk, and some of the stools were to assume the appearance of bushes of pampas grass, and if also the plants taken from such cane, as well as the ratoons grown therefrom, were to exhibit signs of the disease in a still more pronounced manner, it might be said with some reason that the cane was attacked by sereh or a disease very similar to it.

The following observations may contribute to our acquiring some understanding of the nature of the disease:—Cane afflicted with sereh is especially found close to the irrigation ditches. The Cheribon district, where the disease was first discovered, consists largely of low-lying land. Fields on elevated land have been found to be less subject to disease than low-lying fields under otherwise similar conditions. The treatment of the soil with lime seems to favour the disease, while the application of acid bodies—acid fermented molasses, acid manures, &c.,—seems to check it. These observations, however, require corroboration. Late planting towards the end of the dry season seems to favour the disease; early planting not long after the beginning of the dry season appears to retard its progress. Cuttings taken from the very top of the cane give much less diseased cane than do those from the main stalk. The weakest stools exhibit the signs of disease first. Cane much attacked by borers or other insects is rendered more liable to disease than cane not so afflicted. Cane sick with sereh is much more attacked by parasites than sound cane. It is believed by many that the germs of disease are carried by the air.

There is nearly unanimity of opinion with regard to the infectious character of the disease. Not only experiments, but also the way in which the disease has spread, support this opinion. From the western district of Cheribon the disease has slowly advanced with almost wave-like front towards the east; and whereas in 1888 only Western and Middle Java were infected, the canefields of also Eastern Java are now attacked. The damage done by the sereh in some parts is very great. Districts have been known where the sereh has reduced the crop by 80 per cent., which means a much greater loss for those mills which suffered chiefly. It is reported that in some cases even only 25 per cent. of the ordinary crop was obtained from sereh-infected fields.

That the Java planters have been very eager in their endeavours to find a remedy against the sereh is easily understood. But so far they have not been very successful. A few years ago great hopes were set upon the introduction of new varieties from other countries, especially as regards a certain variety found in Borneo, and fabulous sums were spent for the purpose. The Borneo cane at first showed very vigorous growth, but in the 1890 season it suffered in many places, even more than the old varieties. It is said in explanation that the commencement of the wet season was unusually dry for that year's cane, and that the Borneo cane is very sensitive to want of moisture. This would support the theory of the disease being favoured by conditions of weakening influence on the growth. Nevertheless, the belief in new varieties from other countries seems to be yet very strong, as it was reported quite lately that it was intended to procure a large supply of plants from India.

Amongst the other remedies for the sereh which have been tried with more or less partial success are the disinfection of the fields with sulphate of iron, sulphate of copper, or naphthaline; the heating of the land with fermented molasses, which had been allowed to get sour; the steeping of the cuttings after spliting and drying in thin solutions of carbolic acid, sulphate of copper, chloride of mercury, and other disinfecting agents; also, last but not least, the application of artificial and organic manures—stable manure, compost, &c.—with or without a thorough improvement of the cultivation all round. The disinfection of the fields with sulphate of iron and copper sulphate has resulted in considerable success in some cases, and the steeping of the cuttings is also reported on favourably by some, though disparagingly by others, but it seems that none of these means come up to artificial manuring, combined with improved cultivation all round. In fact, the opinion already alluded to seems now to gain ground that the sereh is favoured by influences which are adverse to a healthy development of the cane, and that provided the cane is planted in well prepared soil, carefully treated, and well manured with artificial and organic manures, and that the importance of a wise change of plants is not forgotten, the disease may be held at bay.

Dr. Trenbuer, the director of the renowned botanical gardens of Buitenzorg, and Dr. Ostermann, a cane planter of Middle Java, have, from plants obtained from much diseased cane, got cane which was sound to all appearances, and of vigorous growth. In Dr. Ostermann's case the explanation is added that first-class soil was chosen for the experiment, and that the soil was turned over by the spade to a great depth, liberally manured with stable manure, and well cultivated. From one of the cuttings of badly diseased cane he obtained in this experiment twelve stalks, weighing 59 lb.

That Mr. Lucas, planter, of Tegal, reports a diminution for 1890 of the damages done by sereh in his district is also a very important statement, and perhaps stands in some relation to improved cultivation.

It may sound paradoxical to any one who knows of cane cultivation in Australia and in Java to speak in these colonies of the importance of improvements in the cultivation of the latter country. The care taken there in the canefields is extreme as compared with the care bestowed on the cane in Australia. The laying-out of the fields, the selection of the plants, the planting and the weeding, are all carried out to perfection, and no cane is grown without irrigation, and scarcely any without some manuring. Yet there are still great defects in the cultivation. The fields are planted with cane immediately after the preceding crop is taken off. The crop, in most cases, is flood rice, for the cultivation of which the fields are for a long time under water. The easy means of getting water for irrigation may also often be the reason for using an excess of it during the cultivation of the cane. The land is prepared by the plough only in exceptional cases, and as a rule not more than part of it, say about a half or less of the whole area, is turned over by the spade, with the Reynoso system in vogue, though the working of the soil is done to a great depth in the plant furrows. The soil is systematically impoverished in organic matter, as night-soil or stable manure is seldom used, and the trash is burnt in the mill.

What may be the exact nature of the disease is a mystery yet, though this question has been the subject of study for a number of years by a great number of scientific men resident in Java, and partly engaged by the sugar manufacturers for that special purpose.

Dr. Kruger, who for several years held the position of head of the trial station of Western Java, is confident that the disease is caused by bacteria which have not yet been discovered.

Dr. Soltwedel, the head of the trial station of Middle Java, now deceased, had the firm belief that similar parasites to those causing disease in the beet, and living upon the roots of the cane, are the cause of the sereh. These parasites are called nematodes.

It seems that both these theories have a good many partisans. It is contended by the followers of Dr. Kruger that though nematodes have been found in the roots of diseased cane, and in the soil of infected fields, they can only be considered secondary symptoms consequent upon other primary causes. On the other hand, it has been found in several experiments, especially in those carried out by Mr. Poel, manager of Kali Woengoe, near Kendal, that the disinfection of the soil of infected fields is followed by fair success. This may support the nematode theory. Mr. Kobus, whose name has already been mentioned, reports also to have seen experiments which point to an infection of the roots as being the cause of the sereh.

Mr. Van der Wiel, head chemist of a large sugar manufacturing firm of Eastern Java, believes that the disease is a consequence of the propagation of the cane by cuttings instead of seed (*Landbouwer*, June, 1890). This theory does not stand on the same lines with the two mentioned above, as it does not give an explanation of the character of the disease, but refers only to the way in which the disease may have been brought about. If the propagation by cuttings has really been the cause of the disease it may have favoured bacteria, or nematodes, or some other agent, which then became the immediate cause of the disease.—*The Queenslander.*

"Arrowing" and its relation to the present Disorder in the Sugar-cane.*

By E. de P. O'Kelly,
Department of Agriculture.

In order that the subject of my paper may be better understood, and rendered clear to you, it is requisite that I should refer briefly to the peculiar organisation of the cane plant, its structure and development.

Most of you are aware that the propagation of the cane plant is effected by cuttings, or "sets" taken from the cane itself. These cuttings are taken usually from the upper joints, commonly called the "cane-top," though sometimes the entire stalk is cut up in pieces and planted out, as every part possessing a healthy bud will develop into a plant. Each joint is furnished with one bud, and the "sets" consist of two or more joints. On being planted the joints shoot forth, and at the same time roots issue from the development of the sap-vessels, which are arranged around the whole circle of each joint. These are called radical points, and serve to supply the young plants with moisture and nourishment till they are strong enough to throw out roots of their own. I wish to draw your attention especially to this function on the part of the parent "set," as I shall refer to it later on in dealing with the present disorder in the cane on the Lower River. The roots that emanate from the radical points on the joints of the cane "set" supply the young shoots with sap, consisting of a watery solution of earthy salts, until such period as the shoots acquire perfect roots of their own, when the parent "set," having completed its functions, decays and dies.

Should anything happen to deprive the cane "sets" of these roots, the young shoots will grow for a short time, and then gradually die out, thus showing that the contents of the cane "set," which consist principally of albumenoids, sugar, and mucilage, are not sufficient for the healthy nourishment of the young shoots, and that they require roots to supply them with that nourishment they derive from the soil.

Passing over the early development of the cane, we arrive at the period when it begins to make joints, the first joint requiring four or five months for its entire growth. Attached to each joint of the plant is a leaf, which serves as a reservoir of reserve materials in connection not only with the bud it envelops, but also the development of its own particular joint, so that if this leaf is removed, or any injury occurs to it before it has completed its functions, both the bud and joint suffer accordingly, and the latter is never fully developed.

* Paper read before the Clarence P. and A. Association.

I now pass on to that important event in the life of the cane, called "arrowing," which natural phenomenon takes place when the period of ripening is reached, and stoppage of growth has occurred.

This development on the part of the cane, which has become so wide-spread on this river during recent years, is now regarded by the farmers as a calamity, inasmuch as it has led to a disorder which may be regarded almost as a specific disease, viz., "checked arrow." As I shall deal with this question of "checked arrowing" later on, I will draw your attention briefly to the question of "arrowing" in the cane.

What is arrowing? Why has it developed only within recent years? Can it be prevented?

These are questions which will naturally suggest themselves to those interested in the cane industry on this river.

"Arrowing" is the natural development of the cane, when it has arrived at that stage that it has completed its growth, and following the usual course to which most plants are subjected, it endeavours to reproduce its species. At this time the joints that spring forth are without buds, and the sap-vessels with which they were supplied, pass into the leaves. The terminal bud or point of vegetation develops into a thin joint 4 or 5 feet long called the arrow, and this is terminated by a panicle of feathery flowers about 20 inches long, commonly called the tassel. This "tassel" or flower was supposed, until very recently, to produce no true seed, but this has lately been proved a fallacy. The cane having completed the development of arrowing, will gradually decay and die out, this process of decay extending generally over a period of six months and even more.

In order to answer the second question satisfactorily it will be necessary to explain that so long as the soil is rich in plant food, and the temperature and moisture sufficient, without being excessive, the point of vegetation or terminal bud is being supplied with all the food and moisture it demands; hence no stoppage of growth occurs, and instead of "arrowing" the cane increases in length and forms new leaves. The dangerous period of cold and dry weather is, therefore, passed, the rainy season comes round, and the cane will attain its maximum development without stoppage of growth, which determines the ripening or "arrowing" period.

In the early days of cane planting the natural fertility of the exceptionally rich soil on this river supplied the cane with abundance of plant food, and thus enabled the terminal bud to continue growth; but now that the soil is impoverished by continuous cropping, the cane is starved out through not receiving proper nourishment from the soil, the growth stops, and the consequence is premature "arrowing."

Can "arrowing" be prevented?

No; it cannot be prevented, as it is a natural development, but it can be delayed by careful and intense cultivation. By satisfying the demands of the terminal bud with food and moisture its premature transformation into the "arrow" can be retarded. This can only be done by restoring your soil to its former productiveness. By this means a proper supply of food materials is ensured to the plant and the activity of the terminal bud or point of vegetation is kept up.

The fixed impression amongst the generality of the farmers regarding the present disorder in the cane is that it is a "blight," caused by atmospheric or climatic agencies, and that it is in no way attributable to "arrowing" or "checked arrowing."

I must admit that at first I was inclined to be of the same opinion, but after very careful investigations recently made on Mr. Rankin's farm at

Chatsworth, Mr. Geo. Morrison's at Goodwood Island, Mr. Law's at Harwood, and others, I have altered that opinion, and my observations, based purely on the physiological conditions of the cane, have led me to the conclusion that this disorder is to be attributed to "checked arrowing." I wish to draw a marked distinction between "arrowed cane," which has developed a healthy flower, and "checked arrow," which has failed to produce any flower.

Plants taken from "arrowed" cane will, as a rule, produce cane that will "arrow" unless outside influences interfere with the development, in which case failure on the part of the terminal bud to transform into the "arrow" produces, in my opinion, the present disorder; it makes the attempt and perishes over it. Whether from physical incapacity to reproduce its species, brought about by insufficient plant nourishment, propagating year after year from the same stock and exhausted soil, or whether this check is caused by climatic influences is a question I am not prepared to express a decided opinion upon.

The general appearance of the cane led me at first to fall in with the popular belief that the cane was affected with a blight, or rather, that a fungus attacked the leaves first, causing them to decay and die; and the cane being thus deprived of the functional requirements supplied by the leaves, became stunted, decayed, and gradually died out.

My recent investigations, however, have elicited the following facts:—

External appearances.

The stalk, at an early stage of the disease, looks perfectly healthy, especially in 10 or 12 months old cane.

The leaves and top gradually become decayed and withered; the lower leaves, though perfectly dead, cling closely to the body of the cane, proving that they have died out prematurely, before completing their natural functions. In many instances the buds on the upper joints have sprouted, pointing to the fact that the normal growth of the terminal bud or point of vegetation has received a fatal injury.

The buds that have sprouted also show marked signs of disorder, the radical leaves being twisted and distorted.

Stalks will often be seen in an affected field, which have completed the function of "arrowing," and have developed a healthy flower, and these particular stalks are healthy and have green leaves, in striking contrast to the affected stalks in the same stool.

The roots appear to be stunted, and to have penetrated only a few inches into the ground, and an entire stool of cane can often be dug up with one shallow dig of the spade.

On splitting open several hundreds of these canes lengthwise I could observe the disorder in its different stages.

The cane in its earliest stage exhibits no external signs of withering either in the stalk, leaves, or top, and to any but a close observer appears perfectly healthy.

On splitting open the cane, however, a light reddish discolouration will be discovered at the base of the terminal bud or point of vegetation. This discolouration is sometimes so faint as to be imperceptible to the naked eye, requiring a powerful lens to distinguish it. The discolouration deepens to a bright rusty red as it spreads. As it descends, the sap-vessels of the radical points on the nodes or joints become red and decayed, and in its ascent the top decays, dies, and gradually drops off. The decay of the stalk is very gradual, taking some six months and even more to completely die;

out; and in many instances the decay is entirely arrested by suckers sprouting from the upper joints, which, in fact, take the place of the terminal bud. The stalk, when cut transversely, exudes a yellow gummy matter, which is causing considerable trouble to the mill-owners in the manufacture of sugar. I will refer to an instance of this later on.

Among the many affected stalks that I examined internally, I found some that had accomplished the early stage of "arrowing," the embryo, about the size of a coffee bean, being fully formed; others also were in various stages of development, even to the full formation of the panicle, but in all cases the "arrow" had been suppressed, and decay and fermentation had set in at the point of vegetation in the manner I have already described.

Referring to the yellow viscous matter that oozes from the cane when cut, I found Mr. Morrison, of Goodwood Island, was having great trouble with his diseased cane, and that it was with the greatest difficulty that he could get it to crystallise in the vacuum pan.

The juice in the pan was sticky, and had all the appearance and consistency of gum.

I obtained a sample of the juice taken from the rollers, had an analysis made of it, and, rather to my surprise, the analysis showed the following good results:—

Cane sugar ...	16·67
Brix ...	17·95
Quotient of purity ...	·93
Specific gravity of juice ...	1·0741

Equals 9·95 Beaumé.

I found that this analysis showed better results than the average of healthy cane crushed at the Harwood Mill, and that Mr. Morrison should have no difficulty in making sugar out of it. When, however, acetate of lead was applied to the juice, it had the effect of curdling it instead of defecating it, as in the case of sound juice.

Mr. Rankin, of Chatsworth, in giving me his experience of this disorder in the cane, says that he has over 100 acres of cane, the whole of which is affected. He first noticed that there was something wrong in the cane in July, 1891, after four nights of frost. Had it been cut that season as twelve-months-old cane, he estimated it would have averaged 13 tons to the acre, but it continued to wither and die, did not tassel, and when cut this season as two-year-old cane, gave an average of 10 tons of cane to the acre. There were 60 acres of this cane. On twelve-months-old plant cane the disorder was first noticed about the same time (July, 1891).

When planted, it made a good "spring," and continued to grow healthily till July last year.

The twelve-months-old ratoons were effected in the same way, but they were much worse than the plant cane.

Mr. Rankin believes that he propagated the disease two years ago by planting from unhealthy plants.

He is a strong advocate for the introduction of new varieties of cane from sugar-growing countries outside the Colony.

Mr. Morrison's experience of the disorder is very similar to that of Mr. Rankin's.

The whole of his area of cane, over 100 acres, is affected.

My reasons for attributing this disorder in the cane to "checked arrowing," are:—

1st. That its physiological condition points to its having made an effort to arrow.

2nd. That at the time the disorder makes its appearance, the cane has arrived at maturity, and is therefore disposed to "arrow." That in this condition it is very susceptible to cold or frost.

3rd. That healthy suckers spring from the roots, and healthy ratoons spring up and grow well until they arrive at maturity, when they succumb in the same manner as the parent plant.

The question "what causes this check in arrowing," is one difficult to answer satisfactorily. There are some who attribute it to climatic, and others to atmospheric influences, but so far, I have heard no tangible reasons advanced for these opinions.

It is for the very reason that I cannot propound any evincible theory to account for this suppression in the "arrow," that I am loath to express a decided opinion on the matter, at the same time I am inclined to attribute this suppression to the cold nights experienced during the early part of the winter.

I know I shall be at once met with the objection, that this has been an exceptionally mild winter, and yet the disorder in the cane has been more widespread this year than any previous year. Why did not the cane suffer from "checked arrowing," in former years when frosts prevailed?

To this I answer that in previous years the cane took longer to arrive at the "arrowing" stage, that period being delayed through the natural fertility of the soil, from which the terminal bud receives a supply of food and moisture sufficient for its demand. Under these conditions the stoppage of growth, which determines the ripening of the cane, is delayed.

If the condition of the cane at this period of "arrowing" is taken into consideration, it will be understood that it is necessarily more susceptible at this time to the variations of heat and cold. As I have already explained the development of "arrowing," it will only be necessary for me to state that the elongation of the terminal bud which eventuates into the "arrow" is delicate, watery, and easily injured, though, after complete development, it subsequently becomes much stronger, richer in substance, and more solid.

Again this disorder of "checked arrowing" is unknown in tropical countries, the usual development of "arrowing" occurring with regularity every year. Yet tropical countries are exposed to much the same climatic and atmospheric influences, with the exception of cold, as this district is.

I have so far refrained from making any remarks regarding the fertility of the soil on the Lower Clarence, as so much has been said and written on this subject, and it is familiar to everyone on this river that the land on the Lower Clarence does not possess the same depth of surface soil, the same porous subsoil, or the same amount of fertility, as that higher up the river, but from constant cropping year after year of the same variety of crop, grown from the same seed, the soil is evidently suffering from exhaustion, and the cane from deterioration.

Frequently have farmers remarked to me that exhaustion of the soil could not be the cause of the disorder in the cane, because they had planted a piece of virgin soil with cane, with the result that it was affected by the "blight," as they call it, but when asked where they obtained their plants, the reply always elicited the fact that the plants were obtained from cane grown some time on their farms where "arrowing" was prevalent, that they did not examine the plants carefully enough to state positively whether they were healthy or not, and the inference is that these plants were from cane suffering from "checked arrow," or from cane that had "arrowed."

I have so far dealt only with the effects of checked arrowing, I will now refer briefly to the result of planting "sets" taken from cane affected with "checked arrow."

As a rule these "sets" are taken when the decay has descended only to the few upper joints, and the external appearance of the cane is healthy.

The "sets" that are taken from these upper joints are in the following condition:—The sap-vessels of the radical points on the nodes or joints have commenced to decay, as is apparent by their red, rusty colour. Thus the rootlets that should issue from the radical points on the "sets" being decayed, cannot do so. The young plant, therefore, as I have previously explained, will live on the moisture, &c., contained in the parent "set" until that moisture is exhausted, or until the "set" dies or decays, which it does without completing its function of supplying moisture to the young plant until it is strong enough to throw out roots of its own.

The young plant, therefore, when the supply of moisture has been exhausted from the cane "set," shows signs of disorder. The top leaves turn yellow and wither, outer leaves, instead of expanding in a natural manner, close up at the top. In the meantime the inner leaves are growing, and become twisted and contorted in the endeavour to force themselves out of their confinement. Exactly the same development can be seen in the shoots which sprout from the growing cane suffering from "checked arrow." The plant eventually dies out at four or five months old, and though other suckers spring from the stool and from the "sets" taken from the lower joints of the cane which the decay had not reached, they never grow into vigorous canes, and when old enough make an abortive effort to "arrow," and die in the attempt.

It may be objected that in attributing the disorder in the cane to "checked-arrowing" I have given no explanation as to why this "checked arrowing" is confined to the Lower Clarence, and on the Upper River the "arrow" develops and produces a healthy tassel. In reply to this objection I would point to the fact that the soil on the Lower Clarence differs considerably from that on the upper portion of the river, being much poorer in those constituents necessary for the healthy growth of the cane. Both the soil and plants are proportionately deteriorated, and the plants are therefore in a much weaker condition than those on the Upper River, and I am inclined to think that as this "arrowing" function unfortunately occurs during the winter months, that in its enfeebled condition, further increased by its efforts to "arrow," it is more susceptible then than at any other time to cold, and that the "checking" in the "arrow" occurs at this time.

On the Upper River, owing to the more fertile nature of the soil, from which the plant is furnished with sufficient plant food, &c., to enable the terminal bud or point of vegetation to continue growth, the period of "arrowing" is delayed, and the winter months passed without the "arrowing" having taken place. I find that the cane on the upper portion of the river "arrows" at least two months later than cane on the Lower River. It is therefore not exposed to the cold nights in the condition of "arrowing" as the cane on the Lower Clarence is.

The remedy for this disorder is clear and self-evident.

All affected areas should be ploughed up and burnt or otherwise destroyed, and further propagation from infected plants immediately stopped.

The introduction of new varieties of cane is very desirable, but the plants when introduced should be subjected to antiseptic remedies, to prevent the introduction of any specific diseases from other countries.

In the meantime, plant cane should be obtained from the Richmond and Tweed Rivers, or even from the upper portion of this river, where "arrowing" has not yet occurred.

The Colonial Sugar Company have taken a step in the right direction, by supplying their farmers with healthy plants from the Upper Clarence and Richmond, but the benefit obtained will be only temporary, unless the farmers reciprocate by initiating a rational method of cultivation.

Believe me or not as you will, there is no disease but what is caused directly or indirectly by withholding from the plant the essentials necessary for its existence.

Return to the soil some of the elements that you have unsparingly deprived it of by a proper system of agriculture.

By this means you will give the plant an opportunity of growing vigorously, and under the conditions of food nourishment necessary to its development, the canes will grow healthy and strong.

There should exist between the farmer and his soil *reciprocity*.

Experiments in Centrifugaling.*

THE following experiments were made to determine the influence of wash-water on the centrifugal. The *masse cuite* had a composition of sucrose, 73·1 per cent.; glucose, 7·69; moisture, 9·15; solids not sugar, 10·04.

It was taken hot from the pan and put into a car, and from this weights were taken. This work continued until the *masse cuite* got so hard that it had to be handled with a spade. Nine different experiments were made—three without any water, and the rest with water, varying from 2½ to 25 per cent. It was contemplated at the beginning of the experiments to use saturated (white) sugar solutions in different quantities, as with pure water; but before getting to them, another influencing factor became visible, not counted on in the outset. As we proceeded the *masse cuite* cooled, and became harder, and gave relatively greater yields, until finally, by experiment No. 6, it was revealed that the cold *masse cuite*, washed with 5 per cent. of water, gave 7·8 per cent., and 5 per cent. more than the unwashed in the beginning of the experiment. It was now apparent that an increase in the crystals was taking place with the cooling, and any further experiments with a sugar solution as a wash could not be compared with those made while hot. Accordingly three more were made—two with the same quantity of water, and one without water.

The following are the experiments :—

No.	Amount used, lbs, *masse cuite.*	How treated.	lbs. Sugar.	Analysis.	C.P. Sugar.
	lb.		lb.		
1	100	Without water	51·1	94·	53·76
2	100	"	60·	90·5	54·30
3	100	With 12½ lb. water	40·	97·2	38·88
4	100	" 25 "	35·	98·5	34·47
5	100	" 2½ "	60·62	94·8	57·46
6	100	" 5 "	65·	95·2	61·88
7	100	" 7½ "	45·60	93·8	42·76
8	100	Mixed with 7½ lb. of water before centrifugaling.	55·34	95·2	52·68
9	100	Without water	70·20	90·	63·18

The centrifugal was taken to pieces and cleaned after each experiment, and in experiments Nos. 3 and 4, after the *masse cuite* was dried, and before adding the water, the basket was cleaned, and the subsequent washings caught, weighed, and analysed, with following results :—

No. 3 gave 30·6 lb. of washings, containing 48·2 per cent. sucrose and 4·48 per cent. glucose.

* From Bulletin No. 11 (second series) of the Sugar Experiment Station, Auduban Park, New Orleans, La., U.S.A.

No. 4 gave 56·2 lb. of washings, containing 48·8 per cent. sucrose and 4 per cent. glucose; 12½ lb. water then washed out of the centrifugal 14·74 lb. sugar and 1·37 lb. glucose, and 25 lb. water removed 27·42 lb. sugar and 2·24 lb. glucose.

From these experiments these conclusions can be drawn :—

1. That masse cuite in cooling gives a greater yield in the centrifugal, and suggests the propriety, adopted by many planters, of dropping their masse cuite into wagons and keeping for several hours in the hot room.
2. That mixing the water with masse cuite before centrifugaling, gives larger yields than using the same amount in the centrifugal.
3. That for every pound of water used in the centrifugal more than 1lb. of sugar is dissolved.

Commenting on the above, Mr. Despeissis says :—"In large sugar factories the practice is always to allow the masse cuite to cool and crystallize in shallow pans before centrifugaling. Water in small quantity is then added just at the moment the sugar is about to be extracted by centrifugal force. A jet of steam, directed by a pipe into the centrifugal, has the same effect as water. By this means the crystals are cleansed and separated from the treacle. The syrup, however, after being collected, has to be evaporated over again, cooled, and allowed to stand to nourish the crystals. Those extracted by means of the centrifugal form what is called 'seconds.' By repeating the process 'thirds' are obtained."

The Vineyard and the Cellar.

By J. A. DESPEISSIS,
Department of Agriculture.

The Vineyard.

During the month of January, at the time the grapes are turning, any negligence on the part of the vinegrower to cope with the parasitic diseases which are always more prevalent in the summer months, would, in a great measure, endanger the crop. When the grapes are changing colour a vital change comes over the constitution of the vines, which seem at this juncture to be less capable of throwing off diseases.

The vines should be dressed with sulphur for oïdium, and the last dressing of Bordeaux mixture should be given as a palliative remedy against the appearance of Anthracnose or Black Spot; on the early ripening table varieties *eau celeste* might be substituted for Bordeaux mixture, which soils the grapes somewhat, unless the carbonate of copper is washed away by rain before the picking season.

The last scarifying should also be done so as to keep the surface mellow and to eradicate any weeds that might be growing before they shed their seed, as it is not advisable to disturb the vines at the time their energy is concentrated on the operation of maturing the fruit.

Should the weather keep moist, and to prevent any danger of rotting, a few leaves might be sparsely thinned out, so as to promote the free circulation of the air and the access of light.

The Cellar.

The casks, vats, presses, and wine-making appliances should be closely inspected, and any repairs they stand in need of duly carried out before the exigencies of the vintage absorb all the time and attention of the wine-maker.

Raisin-making.

Considering the extraordinary natural advantages which this Colony possesses as regards dryness of climate, fertility of soil, and the suitability of a considerable area of country for the purpose of growing grapes for raisin-making, it is simply astounding that our enterprising farmers in the western and south-western districts should not as yet have added this profitable industry to their system of mixed farming. The advantages are evident and the returns highly remunerative. The demand, however, is limited, but still every pound of the £20,000 or £30,000 worth of raisins and currants imported annually into this Colony alone might, with much ease and profit, be produced here, thus saving to the country the exportation of a large sum of money, besides giving employment on the land to a large

number of labourers. Moreover it should be borne in mind that some of the best varieties of grapes for raisin-making, viz., Muscatel Gordo Blanco and its close parent Muscat of Alexandria, are likewise the most suitable for exportation to distant European markets as fresh fruit, so that by planting them the grower would have the alternative of either selling them as table grapes, exporting them fresh, or making them into raisins, while the unmarketable bunches would still be valuable for the still.

Best Grapes for Raisins and Currants.

Muscatel Gordo Blanco stands easily first on the list of raisin grapes. It is very much like the Muscat of Alexandria, from which it is said to be a seedling, and differs from it by having a lower and more spreading growth, with closer bunches, rounder berries, covered with a thicker and finer bloom, which is more easily preserved during the processes of drying and packing than in the case of Muscats of Alexandria. Its other valuable characteristics are that it is a surer cropper than its parent, sets more freely, and is less subject to Anthracnose or Black Spot. It requires short pruning.

Seedless Sultana.—Much valued on account of the peculiarity which has given its name to the grape. When grown under favourable conditions it is a very heavy cropper, and is pruned long.

Zante and Corinth Currants.—Both requiring long pruning to bear a crop, and in South Australia, where they thrive well when planted on rich soil, I have seen them doing best when trained on trellises, and planted at a distance of 12 feet between the lines, and 24 feet in the rows. Between every two currant vines, three Muscat vines, pruned short and headed low, are planted at 6 feet apart. The currants are trellised about the fourth year, and taken over the tops of the raisin vines. For that purpose a 7-foot post is put at each currant vine. At the top of each post a cross-piece, 3 feet long, is bolted or nailed so as to form a T; a No. 10 steel wire is stretched at each end and another through the post, 1 foot from the top. Two long runners are trained along the lower wire, and the fruit shoots from it, tied up right and left alternately, to the two upper wires borne at the extremities of the cross piece. In that way the currant vines will meet each other in two or three years and can be kept quite clear of the Muscat vines growing beneath.

Muscats will give a good return the third year, while currants will not be in full bearing till the seventh or eighth year, but a crop will be picked the fifth.

Picking.—The grapes should never be picked for drying before they are dead ripe.

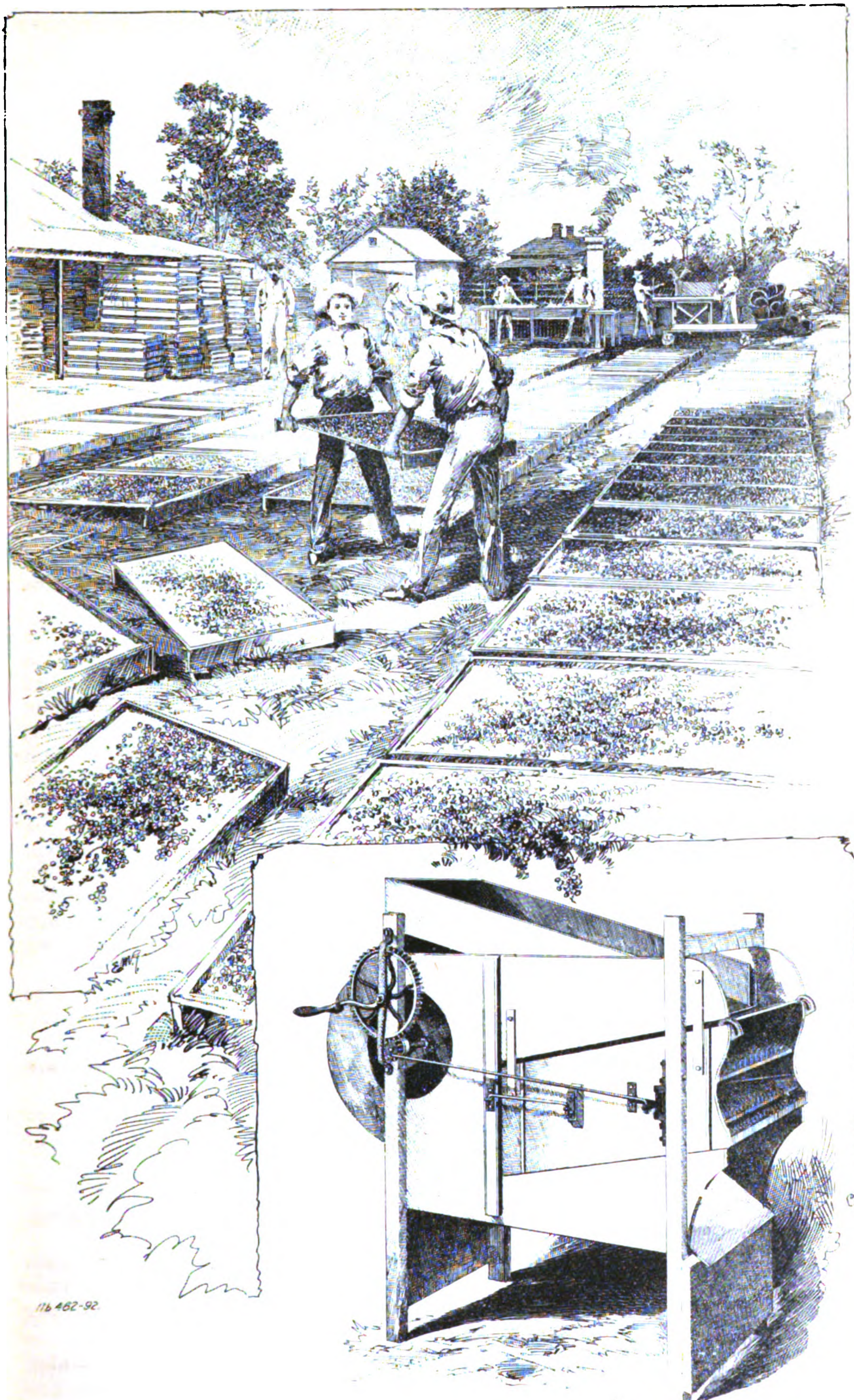
The currant crop is ready for picking a fortnight before the Muscats, and the same trays answer for drying both crops, so that the advantage of growing them together is evident.

There are several ways of ascertaining whether the crop is fully ripe:—

1st. By the colour, which, in the case of the Muscatel Gordo Blanco, should be a bright amber, and also by the taste.

2nd. By the saccharometer, which gives more accurate indications, as a bunch grown in the shade may be ripe and yet colourless. It is reckoned that the juice of the grape should contain at least 25 per cent. of grape sugar to produce a good raisin.

Great care should be taken in picking not to remove the bloom, which would spoil the appearance of the raisin. For that reason the bunch is



RAISIN GRADER.

RAISIN-DRYING IN AUSTRALIA.

handled by the stem, cut with a sharp knife, all imperfect berries, pieces of stalk, dead leaves removed, and then placed upon either shallow baskets or directly upon the trays right side up, *i.e.*, the side showing less of the stem. In large vineyards there is economy in placing the trays between the rows of vines and covering them at once with grapes, whereas on a small vineyard it may be convenient to take them all to the kiln or to the drying terrace.

Table Raisins

Are very easily dried. The finest bunches having been carefully picked, as described, they are simply put on wooden trays, made 2 feet wide and 3 feet long. If too large they are not so convenient to handle when filled. Each tray receives 20 lb. to 30 lb. of grapes, which should produce 6 lb. to 10 lb. of raisins, after having been put out in the sun or in the kiln to dry.

Upon the state of the weather and the size and degree of ripeness of the berries will the time required for drying depend. Rapid drying gives a hard and tough raisin, and should be avoided. At the end of eight to fourteen days, according to circumstances, the grapes being about two-thirds dry, are turned, by placing an empty tray on the top of a full one, and turning them over. A piece of board, 1½ inch to 2 inches high, is nailed at each end of the tray, so that there is always a clear space between them, and the berries are not crushed while turning, when, on the other hand, should the weather turn wet, or the dew be abundant at night, the trays can be stacked one upon another. After turning the drying will proceed more rapidly, and the raisins should be watched to prevent them from becoming too dry.

Sweat-box.—If the raisins on the trays are examined, some of them will be found dry enough, while some of them may be too dry, and some not sufficiently cured. At this stage the sweat-box is found useful for equalising the sample, and making the stems tough and ready for packing. The sweat-boxes are 7 inches to 8 inches deep, and large enough to admit a tray easily. They contain 110 lb. to 120 lb. of raisins. When emptying the contents of the trays into the sweat-boxes all bunches which are insufficiently dry are placed on a fresh tray for further drying. A ready method of ascertaining whether the berries are sufficiently dry is to roll them gently between the thumb and the finger. If any liquid exudes at the stem end the raisins require further drying.

In transferring the contents of the trays into the sweat-box the raisins are slid off in the same position as when they lay on the tray; to prevent the stems getting entangled two sheets of Manilla paper of the size of the box are put in at intervals as the box is being filled. The sorters have two or three sweat-boxes, and grade the raisins into first, second, and third quality.

When the sweat-boxes are full they are put away one on the top of another for ten to twelve days to sweat, after which they are taken to the packing room, which is provided with tables, scales, presses, and neat boxes of different sizes, holding 5 lb., 10 lb., 15 lb., and 20 lb., in layers of 5 lb. each.

Pudding Raisins

Are sometimes made of the same grape when loose and of inferior quality, and also of the Seedless Sultana.

For that purpose the grapes are picked when ripe, put into ozier baskets, and dipped for fifteen to twenty seconds in boiling lye, made of 1 lb. of potash, or of washing soda, to 3 gallons of water, and then plunged in fresh water for a rinsing, and then placed on trays. The object of the dipping is

to make the drying process more active, by dissolving or saponifying the waxy covering which constitutes the bloom, and opening up the pores on the skin, thereby allowing the moisture to escape more freely from the fruit.

The grapes are then placed on trays, put on a truck, which is wheeled for a few minutes into a small hut, which can be hermetically closed, and in which sulphur is burning. The sulphuring is done with a view of obtaining the well-known amber colour of the pudding raisins, which does not in any way improve its quality, but is merely done to comply with the demand of the market. From the sulphur chamber the raisins are dried either partially or entirely on the trays, and put through the stemmer and grader. The stemmer removes the berries from the stems, and the grader, by separating according to size, determines the grade.

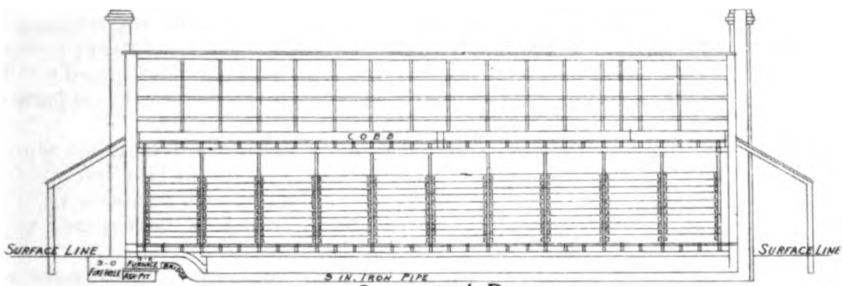
The accompanying plates, prepared from photographs I took last vintage at Mr. Kavanagh's Lake Erie vineyard, Mooroopna, in the Goulburn Valley, Vic., show the drying terrace with the lye furnace; truck loaded with trays for sulphuring; drying kiln; also the grader, which is constructed much like a winnowing machine, and the raisin press.

Since the introduction of evaporators and kilns for drying fruits and raisins, the industry has been successfully and extensively carried out in districts which, owing to the uncertainty and the wetness of the seasons, would not permit of conducting the process of fruit-drying, simple as it is, in the open air. For the information of vinegrowers who might be desirous of constructing a cheap and efficient drying kiln, the following plan, with accompanying specifications, is submitted:—

Specification of Raisin-drying Kiln.

Drying kiln 50 feet long and 22 feet 6 inches wide and 8 feet high. The dividing wall and the two side walls are of cob 18 inches thick. Cob is the surface soil and subsoil excavated from the site of the building, thoroughly wetted and worked together, then turned over and mixed with straw, and then built up as a wall. The two ends and furnaces are of brick. In each kiln there are two lengths of wrought-iron pipes 9 inches in diameter, with a furnace at each end. Thus the heat is equalised throughout, and there are racks on each side of the kiln on which ten trays can be placed over each other, and ten trays in length. Thus in the two kilns four hundred trays can be put in at a time.

The iron pipes are laid 2 feet below the floor. The foundations of all the walls are first dug out 2 feet 3 inches deep, the cuttings filled in with concrete, made of gravel, broken stones, sand and lime, to 3 inches above the surface for the centre and side walls. For the end walls start with brickwork from the bottom, so as to build two furnaces at each end and two flues for the furnaces at the opposite ends. Dig the centre out to the depth of the foundations, and build the wall with same. The pipes are 9 inches in diameter, made in 4-feet lengths telescoped into one another and laid in the bottom of the ground. Thus they are 2 feet 3 inches in the plate, 2 feet 5 inches below the joists carrying the floor, which consists of 6 x 1 inch boards laid roughly and nearly close together. The ceiling overhead is covered with 9 inches of mud cob, same as walls, over which is a galvanised iron roof and a verandah.



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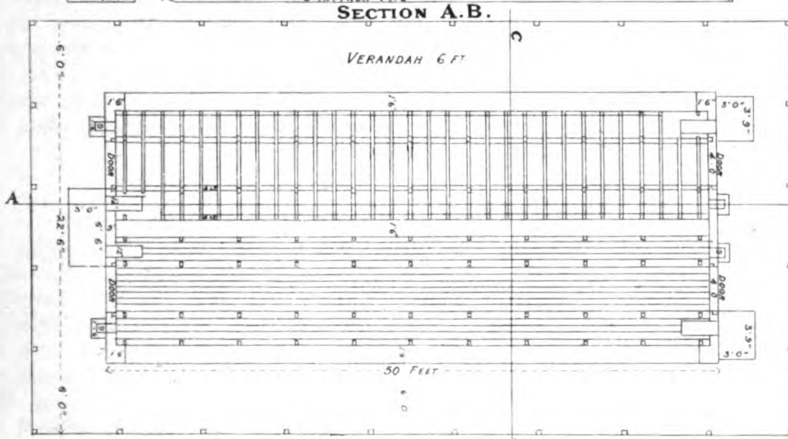
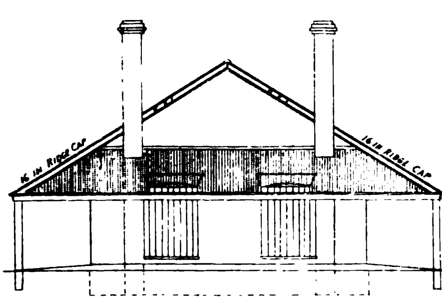
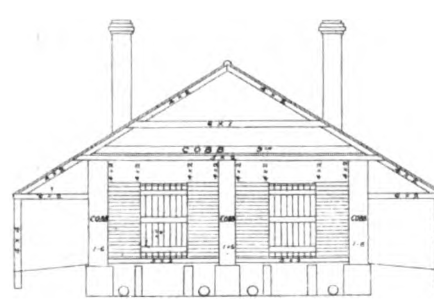


GROUND PLAN



END ELEVATION.



SECTION C.D.

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PLAN OF DRYING KILN.

The Australian Wine Trade.*

By HANS W. IRVINE.

The most confirmed sceptics have been compelled to confess that it is possible to produce various wines of excellent class and character in Australia. The weight of evidence is such that there is no longer any room for doubt on this point. The soil and climate in many districts of Victoria, South Australia, New South Wales, Western Australia, and Queensland have been found generously responsive to the efforts of the vignerons; and many of the leading wine merchants of London and other important commercial centres admit that Australia promises to become a powerful rival in the world's markets with the old-established vineyards of Europe.

Land that the pioneers of this country counted worthless for cultivation purposes has been found peculiarly suited to the growth of the vine and for the production of light and full-bodied wines. There are hundreds of thousands of acres of land, scrub covered and ignored by the selector, that is admirably adapted for purposes of viticulture; while many of the richer soils which have been brought under cultivation are specially suited to the production of wines of an excellent character.

Gold-mining—the industry which laid the foundation of success in Australia, and which has placed Victoria in the proud position she holds to-day among the British colonies—is rapidly declining, but in process of time I doubt not but that the old gold-fields, and some of the vast areas of country at this moment reserved for mining purposes, once they have been thoroughly prospected, will be thrown open for cultivation, and there will settle thereupon men of experience, pluck, and foresight, who will speedily convert the wilderness into flourishing, picturesque, and thriving vineyards and orchards. In the stead of the gold-mining industry to which we are largely indebted for our present prosperity there is springing up another, which will give better hostages to fortune and guarantee a greater permanency to the well-being of the several colonies constituting Australia than has hitherto been enjoyed.

It is gratifying to know that many of the wines of Australia have suffered no disparagement when compared with some of the rarest European vintages, but on the other hand Australian vignerons have much cause for gratulation in that their wines compare so well as they do with the world-famous products of France, Germany, and Spain. This is the more satisfactory, as wine-making has formed a leading feature of the industries of Europe from time immemorial, while it has but recently been recognised as of any great importance here. From a viticulturist's point of view the

* Compiled at the request of the Minister of Agriculture, Victoria, and published by the Victorian Department.

advantages are largely with the European growers, who have centuries of experience to guide them in the management of their vineyards and wines. The Australian growers have, metaphorically, to feel their way, and avail themselves of such opportunities as present themselves for acquiring information.

The peculiarities of the Australian soil and climate are being carefully noted, and such experience has been gained in this respect that already the observant wine-grower knows the kind of vines to plant and the quality and character of the wines produced in the several wine-growing districts of Australia. It may, therefore, be claimed that the first, or experimental, stage is past, and that the wine-grower can confidently look forward to reaping an abundant harvest; the result, of course, will depend upon whether the teachings of the past have been taken advantage of.

It is at once interesting and instructive to study the

Growth and Progress of Viticulture

in Australia, as therein one learns where the pioneers of the industry have erred; where they have secured a victory; and in what manner they have succeeded in bringing it to that stage we find it occupying to-day. Although the pioneers made many attempts to create an export trade with Great Britain, it was not until the Indian and Colonial Exhibition, held in London in 1885–6, that much attention was practically given to the resources of Australia as a promising wine-producing country.

Though success did not attend the efforts of the pioneers in the establishment of an export trade, with praiseworthy persistency they did not relax their efforts for a moment. The failure they experienced may, in a large part, be accounted for by the fact that they were ahead of the times. In forcing the trade before there was a sufficiency of matured wines here to back their efforts they subjected Australia to an unfair comparison with the wines of Bordeaux and other important and old-established centres of Europe. Nor should the blame of this be attributed wholly to the pioneer exporters, who, we are well aware, were in a measure forced to this course by reason of the small home consumption. Growers should now be in a position to take advantage of the causes of failure, and determine to ship only such wines as, calculated on the basis of the experience gained, would command a large and ready sale. The pioneers of the industry saw the necessity of (1) ascertaining if the wines of Australia would suit and command a market in England when compared with the vintages of the world; and (2), in the event of such proving to be the case, whether it would be advisable to bring larger areas under vines, so as to provide for the establishment of the trade on a larger scale.

It may now be assumed that Australian wine shippers are conversant with what is required of them and of what has actually been accomplished. For much of the knowledge, as also for the sound prospects which the industry enjoys at this moment, those engaged in the wine trade to-day are under a debt of gratitude to the founders of the industry, who, at heavy pecuniary loss and much personal inconvenience, paved the way for an enormous trade.

The progress has been painfully slow. So long ago as 1873 large parcels of wines were sent respectively to London and Vienna for exhibition from this country. At both places the wines were highly spoken of, and at Vienna the highest award—the diploma of honour—was awarded the Victorian exhibit. From that time to the present the wines have continued to grow in favour, yet one must perforce confess that the results still fall

far short of expectations. The future, however, is brighter, rosier, more encouraging than it has hitherto seemed. It only required to be clearly demonstrated that viticulture might be profitably practised in Australia to induce many people who had been giving some thought to the subject to plant the vine. Others who had established small vineyards, cheered by successes gained by Australian growers, entered into the industry with greater zest, until such is the momentum now acquired that if due care and attention is paid to planting the proper kinds of vines, and the laws of fermentation, &c., are thoroughly mastered and utilised in the manufacture of wines, a higher standard will be attained, and the result will be a larger export trade.

Some conception of the importance of viticulture may be obtained from the following statistics, culled from a report issued by the French Government:—The approximate value of the 1890 vintage to France was nearly £40,000,000 sterling. Out of this £40,000,000, the produce of the Gironde alone was valued at a little over £6,000,000 sterling, or, to put it in other words, over a sixth of the total value of wines produced in France in that year (1890) came from that department. Not many years ago the quantity of wine produced in France was nearly double that of 1890. It will be understood that this was prior to the disastrous ravages of phylloxera. It is estimated that not fewer than 23,000,000 people in one way or another find employment throughout the year in connection with viticulture in France alone.

Therefore, in speaking of this industry, its capacity for affording labour is a feature that should be borne constantly in mind. Every additional acre planted with vines creates a demand for workers. Consequently the value of the expansion of viticulture gains in importance; for not only does it mean an additional output of wine, but it creates an increased demand for coopers, carpenters, builders, machinists, mechanics, and numerous other tradesmen. The avenues opened up are innumerable, and vignerons are pardonable if they claim that they are founding an industry which will assist largely to absorb the surplus labour which at this moment is causing so much anxiety to all classes of society. Our exports in wine will hereafter have an important bearing upon the maritime trade of the colonies. But what is the use of multiplying examples when the fact is obvious that the ramifications of this young and budding industry are beyond calculation? Nothing could more satisfactorily demonstrate the important position which viticulture has already assumed among our most valuable industries than its expansion during the last few years. In 1888–9 the area under vines in Victoria alone was 12,889 acres, or 1,691 acres more than in 1887–8. The quantity of wine returned was 1,209,442 gallons in 1888–9, or about 42,000 gallons more than in 1887–8, and 206,000 gallons more than in 1885–6. In 1889–90 there were 15,662 acres under vines in this colony, or an increase of 2,773 acres for the twelve months. The quantity of wine returned was 1,578,590 gallons, or more than in 1888–9 by nearly 370,000 gallons, and for 1891 the yield was estimated at 2,008,493 gallons. It is gratifying to observe that the area now under cultivation, but not in bearing, will, in the course of, say, five, or perhaps six, years more than double the present yield, while other large areas are yearly being planted in districts known to be suitable for the production of high-class wines, so that it is only reasonable to suppose that, say, in ten years' time, Victoria, apart from the other colonies, which are also largely and rapidly increasing their areas of vines, will be in a position to export millions of gallons, whereas she can only at present ship hundreds of thousands of gallons. Victoria is in the vanguard,

so far as viticulture is concerned, among the Australian colonies. According to the Government Statist, at the end of the year 1889 the area under vines and the yields in the various colonies were respectively as follows:—

	Acres.		Gallons.
Victoria	15,662	yielding	1,578,590
New South Wales	7,867	„	688,685
South Australia ..	7,352	„	510,674
Queensland ...	1,763	„	164,626

In 1873 there were only 5,222 acres planted in vines in Victoria, and the yield has been estimated at 562,713 gallons, showing an increase for the sixteen years ending 1889 in the area planted of 10,440 acres, and an increase in the yield of 1,015,877 gallons.

The industry progressing at such a rate, and giving such satisfactory indications of still more rapid advancement in the future, the necessity for seeing that it is conducted on proper lines is clearly apparent. The future may bode for this industry good or ill, but we have the controlling of our own destiny. Everything depends upon ourselves. Nature in Australia is most bountiful, and if we avail ourselves of the teachings of the past we may anticipate a glorious prosperity.

Notwithstanding the increase in the amount of wine produced in Victoria, the revenue derivable from the import duty in wines arriving here from other countries was, for 1888–9, £53,147, the largest amount since 1865, when it realised £46,509. These figures may be somewhat difficult to understand, but when we remember that the population in 1865 was only 621,095, and that the population in 1889 was 1,118,028, we may the more readily comprehend the lesson they teach. The revenue from imported wines has fallen off considerably, *pro rata* to the population, since 1865.

The population of Victoria at the last census was 1,140,000, and, as stated already, the quantity of wine produced was 1,578,590 gallons. This wine added to that imported, after deducting that exported, amounts on the average to rather over a gallon per head. The value of the wine produced, as shown, has been on an ascending ratio. In 1883 the value of the wine exported was £11,493; in 1884, £13,450; in 1885, £15,362; in 1886, £27,094; in 1887, £29,345; and in 1888, £33,273, the highest amount reached up to that date.

Australian Wines in the English Market.

The time has arrived when Australian vignerons should be made acquainted with the manner in which our export trade with London is conducted, and the causes which hamper and retard its progress, as, unless the evils are removed, there is but a shadowy prospect of it expanding proportionately to the increase of production here. Wines hitherto purchased by large English buyers have consisted in most part of full-bodied, crude, and coarse young wines of great alcoholic strength. One leading wine merchant in London, through his agent here, stated some time ago that he wanted wines that would register 24 per cent. proof spirit or over, as under that strength they did not carry well or meet the requirements of the trade, and, further, that the demand in England was for that type of wine. As much over as possible, I should say, for this and many other firms dealing in Australian wines in England, inasmuch as they are ignorant beyond belief of any special knowledge of how to treat the finer and more delicate wines, which require not only care but skill and experience, in order that their latent qualities may be properly developed.

In the hands of such men as dominate the Australian wine trade in England our finest vintages, through lack of knowledge and neglect in working, are apt to "go off," as is the case with all really good and delicate wines if not properly cared for; and then we are told that Australian wines, unless strongly fortified with spirit, will not keep.

The merchants appear to be blissfully unconscious of the fact that in nine-tenths of the cases where the wines have gone bad after arrival it was due solely to their own inexperience as to the treatment they should have received.* Many inferior wines are purchased in Australia at low rates, but, considering their quality, at their full value, which may go bad through neglect or in consequence of not having been properly fermented, it is only natural to suppose that wines of this kind will deteriorate still further. Yet they are shipped, and on their arrival in London are "restored," and straightway sold as cheap wines, although they are in many cases decidedly faulty. The restoration after "treatment" consists chiefly of blending them with full, heavy, rich wines from warmer districts, and thus "clothed" and disguised they are sent into consumption as quickly as possible. But the imperfections are only temporarily hidden, and the bad wine speedily commences to assert its supremacy over the good, and in the course of a few weeks, or at most a few months, the whole becomes more faulty and unpalatable. Those who are ignorant of these practices, and who confide implicitly in their merchants, often find their trust abused. They are told that wine improves with age, but they are not told that it is only good, sound, and well-made wine that improves. The customer innocently makes his purchase, stores his wine for a few months or years to allow it to mature, and when, at the expiration of the specified time, he finds that instead of the wine (*sic*) having matured, it has become vinegar, or some mawkish stuff, out of condition and poor in bouquet and quality, his disgust and vexation may be imagined.

I was frequently told when in England that Australian wines would not keep. Several of those with whom I had had conversation had tried them, and condemned them outright. Many of the widely advertised Australian wines of the cheap order, such as I have described above, and which, though fairly satisfactory to the taste for a few months, after leaving the merchants' cellars rapidly decline in character instead of steadily improving with age, as they should do if good, sound, clean wines when bottled. I regret to say that this class of wines constitutes the great bulk of the trade done in Australian wines in England to-day; or, allowing that the cheap class of wines so freely sold in England, in most cases are sound when bottled, as undoubtedly they are, still their youth should be a sufficient reason for their not being bottled, as they are too green and crude, and have not been sufficiently worked and attended to in cask ever to develop into high-class wines, or achieve the promise of their birth; they should first be allowed to attain some measure of cask ripeness. If stored and attended to by the merchants for only a year these good, but green, wines would largely improve in bottle, and assist in adding to our reputation, instead of, as at present, keeping us, to a great extent, on the level of the inferior and cheap wine-producing countries of the world. Very urgent reform is required in this respect, and a better system of storage, until matured, is necessary, as to-day the bulk of the wines sold in bottle in England do not fairly or justly represent the finer growths of Australia. Vignerons generally cannot be expected to store wines till matured—that is the acknowledged work of the merchants—but, as I have previously stated, most of those engaged in the trade in England buy to-day to sell to-morrow, so to speak; and if for this reason alone, and knowing how

some of them conduct their business, it is specially necessary to provide that only good sound wines are allowed to be exported, or otherwise it will be to the detriment of viticulture generally throughout Australia.

I will give one instance out of six or seven that came under my notice while in England, illustrative of what I have just said. I was introduced by a member of the Australian press, in England, to an historical hotel, "Ye Cheshire Cheese." I was unacquainted with the proprietor, and he, upon learning that I was an Australian and identified with the wine trade, at once volunteered to let me taste one of, what he called, the best Australian wines in England, and which he had had laid down in his cellar to improve for some time. I thanked him, and the cellarman was straightway despatched to bring up a bottle. In the meantime another gentleman entered the apartment, to whom I was promptly introduced. I was told that he was the friend of Mr. ——, a leading light in the wine trade. While conversing with him, the wine sent for had been brought and poured out. Judge then of my astonishment when, before I had taken my glass in hand, to hear the friend of Mr. —— exclaim, "I say, Charlie, this is vinegar!" and I was able to fully endorse the statement without having tasted it, the aroma being quite sufficient to condemn it, and proclaim it "acetic." The look of disgust on the countenance of our host was comical to witness, and his air of wounded vanity I shall long remember as he remarked, "I prided myself that you would be able to taste a glass of wine that would please you, and that would do Australia credit. That wine has been in my possession for years. I thought I would lay it down to improve with age, and it turns out like this! We get no encouragement to buy Australian wines—they will not keep." I looked at the brand, and to my amusement found it was one of the most expensive and best advertised samples of Australian wines sold in England, and if any wine ought to have been good, and have given good results, this certainly should have done so. Possibly it had been one of the "clothed" wines already referred to. I have no doubt of it myself, and would question whether it ever was at the vineyard it purported to come from. I am reminded of another instance. I was told on interviewing a gentleman, who was of great assistance to me, and who also takes a keen interest in the Australian wine trade, that out of fifty complaints received in 1890, in connection with a business of nearly £350,000 per annum in wines and spirits alone, and of which he was one of the ruling heads, that forty of the complaints were in connection with the Australian wine trade, of which they sold only a very small quantity, consisting mostly of the best known brands put up, and widely advertised by the merchants. The number of complaints in a gigantic overturn like this, is infinitesimal in proportion to the business done; but when poor Australia is represented only to the extent of a few thousand dozens, representing a few thousand pounds sterling, and four-tenths of the complaints are in connection with her produce, is it any wonder that *bonâ fide* merchants and others, who would take warm interest in developing the trade, have become disgusted with it. Some of the disgusted ones, however, are compelled to keep some stocks in hand, as, through profuse advertising, they are asked for it, but it is needless to say they are small, and only kept to supply the demands of customers who may particularly desire them.

The gentleman above referred to spoke highly of some Australian wines that he had tasted direct from the growers, and through their *bonâ fide* agents, and not received through the middlemen, but he condemned in no measured terms the present commercial or uncommercial manner in which the wines were sent forward from Australia, and still more the English

merchants for placing inferior and faulty wines before the consumers. He told me they could not rely upon receiving the same class and character of any wine twice in succession.

Speaking from my personal experience, and from conversations I had with gentlemen who have given some attention to the subject, I am convinced that most of our wines, handled as they are in London, will not do us credit or improve in value as they ought. In defiance of the statements made by London merchants and others, I maintain, as I have proved it, that wines of low alcoholic strength will keep and improve with age, and if properly fermented before shipping, and carefully managed on arrival at their destination, as all wines ought to be, the complaints I have enumerated would be removed. As a rule, however, as quickly as possible after arrival (and sometimes wines are shipped from Australia under twelve months old), the wines are fined, bottled, and sent into consumption, and I do not hesitate to say that in some instances they have been consumed by the British public when little more than twelve months old. No wonder, under such circumstances, that some of our wines have gained an undesirable reputation as inferior, crude, of no character, and that they deposit a heavy crust of tartar on the bottles. Practical wine-growers know that this should have come out in the bulk by working, and with age. To those who understand the causes, as well as to the uninitiated, this sediment renders the wine dull and unpleasing to the eye. Sometimes young and badly fermented wines are bottled, with the result that the bottles are shattered as a secondary fermentation sets in, and, as happened prior to my visit to London, an explosion of this kind occurred in one of the large retail stores, and an expensive plate-glass window was broken to pieces. The merchant who had supplied the wine, I was informed, paid the cost of repairing the damage.

I would reiterate that wines are frequently, through ignorance, bottled when in a state of fermentation. They are also badly blended, do not receive sufficient care or attention, and are invariably handled by men (though there are some exceptions, I am glad to say) whose sole desire seems to be to make money quickly, regardless of the interests of others. Such men are indeed amassing wealth, solely through an extensive system of advertising, for which I give them credit for conducting on a magnificent scale. The public are the more easily attracted by these advertisements, in that they have a kindly feeling towards Australia or anything Australian. This parental regard to this country renders the British public the more easily gulled, and it is, without doubt, being taken advantage of to a very large extent. The question which pricks home to us is, "Are we, knowing these things, going to rest content, and allow others engaged in the merchandising of our produce to reap the benefits of the whole of our years of toil, smirch our fair fame, and by trickery and ill-disguised cunning, in the way of advertising, work the ruin of the trade which we have for so long, and with much pains, endeavoured to build up?"

The people of England will help us if we will only help ourselves, but we cannot expect that their forbearance will last much longer if the present order of things is perpetuated. Some of the men who are at present engaged in the industry are, without question, making large yearly profits, and yet they proceed on the same lines as they did years ago, holding no stocks worth considering, and offering the lowest prices, without a thought of encouraging the exportation of the better and matured qualities, for which higher values would be obtained. One large merchant was advertising, when I left England, that he had a thousand hogsheads of wine in stock, in a trade paper. What is a thousand hogsheads? At most but 60,000 gallons,

and should represent but three months' trade in a business the magnitude of that transacted by the merchant in question. Such a business should never have less than three years' supply, and then there would, to some extent, be a guarantee that the wine sold was matured, and not twelve months' old wine, purchased in Australia at from 1s. 6d. up to 2s. 6d., or, in rare cases, 3s. per gallon, and sold through the various agencies and grocers, as well as direct to any one ordering, at from 16s. to 42s. per dozen quarts, and even higher rates. The profits, as I have already stated, resulting from this class of trade are enormous, but the encouragement to the grower is *nil*, and the prices offered and paid are far from being commensurate with the labour entailed upon him, and the risk he incurs, the many years of weary waiting he experienced before his vineyard yielded him any return; and these matters are altogether apart from the large expense that must necessarily be contracted for casks, cellars, &c. The merchants who rule the trade to-day resent an independent grower coming forward with large parcels of wine himself in England. They would, if possible, prevent him from ascertaining what the future prospects are like, and place every obstacle in his path, so that he might not learn what the probabilities of an increased trade really are. They endeavour to persuade him that they have sufficient stocks on hand, and, therefore, are not in need of further supplies for some time; as a matter of fact, they are anxious to obtain the wine, but, in pursuance of their policy, they harass the independent shipper, so as to discourage him from making any further attempt to break down their monopoly. They feel assured that the shipper, unable to find buyers, will agree ultimately to sell to them at lower rates. They are confident that it is only a question of waiting, and they will be able to dictate their own terms absolutely to the unfortunate shipper. I regret to say that they are generally correct in their opinions. Misguided Australian growers, who forward shipments to London as a speculation, commit a grievous error, insomuch as they aid the merchants to obtain the consummation of their desires. Small or large growers, who have not sufficient capital behind them to render them independent of the big wine monopolists, might, with as much chance of profits, pour the wines down the channels of the street as send it forward unsold, expecting to get fair prices without being there to superintend the sale or have a representative or agent to attend to it, and push the sale. Buyers are few, and some do not scruple to turn the opportunity to their own advantage. Unless some one interested in the trade is on the spot, and understands the relative values of the wines shipped, the old, old story of the spider and the fly will continue to be repeated.

One large merchant asked me to taste a sample of Australian wine, which had just come out of bond, when I was in his cellar one day, and to give my opinion of it. I did so, and at once told him that it had been a good wine, but through neglect had perished and become flat and dead. He told me that that wine had been shipped from Australia unsold, and had been offered to him twelve months previously, when he declined to purchase, and that he had just bought it at 10d. or 1s. per gallon—I forget which. At that price it would not pay for the empty casks, freight, and storage, so that the shipper would be a heavy loser on the transaction, besides losing the wine. The wine, no doubt, when first offered was young, but good, and worth at least 2s. 6d. per gallon, but it had been sent forward independently, and was therefore poaching on the merchants' manor. Their absolute right to govern and rule the Australian wine trade has been invaded, and his temerity was punished by a refusal to purchase. The merchants alluded to are keenly alive to the fact that if they tolerate the intrusion of growers their autocracy

would from that moment diminish. The new *régime* would mean enhanced prices for the growers, and consequently less profits for themselves; so that, when possible, they resist every effort of the producer to ship direct for sale, as having a tendency of attracting other merchants' attention to the qualities of the wine and the advantages of the trade.

I should indeed be sorry to think that all the London wine merchants in the Australian wine trade were of the same stamp. There are some among them of upright character—men of strict integrity; to do business with whom is a pleasure. Such gentlemen know that my remarks are quite justified, and that I am quoting facts and relating things as I found them, some things extenuating but naught setting down in malice. No doubt much I have said on this subject will be most unpalatable to some, but if the cap fits they may wear it. Although I do not think my remarks will produce any salutary change in them, I am of opinion that it will impel them to greater caution hereafter, as it will suffice to show them that their manner of conducting business is understood out here; and who can say that it will not result in reforms that will redound to our benefit.

I experienced little difficulty in disposing of the whole parcel of wine I had forwarded—over 200 casks—in one line, and at a satisfactory price, being there to superintend the sale myself. I had subsequently the pleasure of hearing that the man who had laboured most to impress me with his own omnipotence, and of the inutility of endeavouring to sell Australian wines at that time in England, as well as the utter folly of Australian growers endeavouring to force a trade independently of the merchants who try to rule it, had, directly upon hearing that I had sold my wines, though he had written to me previously, as well as stated verbally, that he had very heavy stocks, and did not require any wines as the dull season was coming on, &c., &c., bought up in conjunction with, and through another merchant a large quantity of the wines I had sold, and at a good advance upon the prices I had obtained, and at a considerably higher figure than he pays for most of his shipments, and the class of wines in which he has his largest transactions. Needless to say, all this was highly satisfactory to me. The merchant just alluded to afterwards expressed his chagrin, and annoyance at having "stultified" his own action, and I sincerely trust he will take the lesson to heart.

I have said sufficient to show the necessity there is for Australian exporters to take concerted action to protect their interests—to see, most of all, that Australian wines reach the British consumer in a proper condition. This once accomplished, and I do not hesitate to say that very speedily the demand will be such that there will be no difficulty to find a profitable market for all we can at present produce as also the increased production of coming years. The merchants, as I have shown already, who have secured an apparent monopoly have been, and are, the lions in the path, but if sensible means are adopted they will be found powerless to hinder the expansion of the trade to any very appreciable extent.

Many good unblended wines are sold in England by the merchants I have adversely criticised, but the difficulty is, after obtaining them, to know whether you will be able to secure the same quality and character again. The smallness of the stocks held by merchants is alone sufficient to proclaim some inability to guarantee further supplies of the same sorts of wine; and this fact, considered in conjunction with the low price paid to growers for wines which are not stored on arrival until matured, explains the reason for the numerous complaints made against the Australian product. This is an evil that calls for prompt remedy, particularly if we desire to see our trade placed upon a basis like that of the good Bordeaux houses. As to the

shipment of wines of low alcoholic strength, I am fully persuaded that they will carry well, provided that they are properly fermented, fined, carefully attended to, and placed in good clean casks.

To still further illustrate the position assumed by some of the London merchants to the Australian trade, I may mention here that while I was in England I was informed by letter from Victoria that one of the leading wine merchants in London had written to his Australian agent or buyer, informing him that the wines which I have referred to as having sold in one line, and which I had shipped a month ahead of my visit, had arrived in bad condition. The merchant who made this statement well knew at the time of doing so that the very opposite was the case, as he subsequently told me personally that wines rarely arrived in such good condition. This latter assertion I did not credit, nor do I do so at this moment; and it is just possible that immediately after conversing with me, and praising the wines, he sent off the letter referred to to his Australian agent. I have a shrewd suspicion that his only reason for taking the action he did was to cause a still further tendency to lower prices, and to impress the unsophisticated grower with the difficulties (imaginary ones, of course) of shipping and selling wines in England from Australia, as also of the great drawbacks to the trade, &c.; so that in sheer desperation the poor grower, not feeling certain of securing a buyer who would pay proper values, would accept the prices offered rather than run the risk of failure, and probable further loss through having to hold his stocks for a greater length of time. I have no doubt the story about the bad condition of wines referred to was told to many vignerons in Australia by the agent of the London merchant, but I acquit that gentleman of knowingly stating what he knew was not true. I had the wines examined by a chemical expert in England for the sake of having evidence as to how the wines had really arrived, and consequently I was in a position to combat many of the theories industriously propagated by men of the class I have referred to. The report I received was highly satisfactory, and fully bore out my opinion that wines of low alcoholic strength will carry safely, and, if well made, will improve on the voyage.

The Local Market.

While I have been at some pains to expose the faults of the trade in Australian wines in England, it were only justice to draw attention to some of the evils in connection with our home trade. Complaints are frequently made that the market is flooded with young and immature wines, and those who earnestly desire that the industry should prosper, view with regret the practices which so largely obtain. The production is yearly becoming more in excess of the local demand, consequently growers who have not turned their attention to exporting or selling direct to the consumer find a greater difficulty in disposing of their produce, and in the competition prices are lowered to the finest possible margin of profit. At times it is even difficult to sell wines, no matter how low the prices asked. The condition of our market to-day also stands in need of reform, and largely fosters the sale of wines that certainly tend to lower the prestige of the trade. Many of the arguments respecting the formation of a company (hereinafter dealt with) to govern the exports would aptly apply to the home trade. Growers, many of them, must sell their young wines, having neither the casks nor cellarage accommodation for storing two or three years' vintages. The time is most opportune for the formation of a company in this country to purchase young wines, and prepare them for the market. So soon as this is done we may anticipate very much better results to all concerned.

Type of Wine Suited for the English Market.

I have elsewhere stated that the wines at present having the greatest and readiest sale in the English market are mostly full, heavy, coarse, young, red wines, of great body and alcoholic strength, and of a fruity character. The type of wine is easier handled than the finer and more delicate wines, and gives the merchants but very little bother, and on this account is, no doubt, much encouraged. Many of these wines are of most excellent character and quality, and would compare favourably with the best wines of the world in their class when matured. Still, though there is a large demand for them, the class of people who purchase and consume them are not connoisseurs, nor are they looked upon as wine drinkers. Their idea of a good wine is one possessing good body and strength, delicacy of character and bouquet not being included in their reckoning. The merchants have, in a measure, created a demand for these types of wines only, and the wealthier classes of society, who consume large quantities of the rarest and finest wines, have had no proper opportunity of learning that Australia could produce a vintage equal to that of some of the finest Bordeaux or Rhine wines. I maintain that the higher quality of fine, light, delicate, dry wines, with a richness of bouquet such as many districts in Australia are capable of producing, are the kinds of wine we must look forward to for establishing a name and fame for our produce. These are the types of wines drunk by the wealthier classes and connoisseurs, who can appreciate their rare qualities, and it is only necessary to properly introduce these wines to secure a ready and unlimited market for them. Growers who have been devoting most of their attention to this class of wine need not get discouraged because there is no great sale for them at present, for so soon as supplies increase, and the qualities become known, they will find their efforts in that direction amply rewarded. English buyers, having built up their businesses on other wines, have but little sale for the higher and more delicate style of wines, but the time is near at hand when they will be compelled to give more attention to this branch of the trade. So soon as our best growths of white and red wines, of low alcoholic strength, find their way into the market their very excellence will soon make them widely known; merchants will see that a better class of trade is to be done than they have been accustomed to, speedy reforms will follow, and a constant and profitable market will be assured. I do not wish to imply anything disparaging of the full-bodied good red wines at present shipped, as I know they are the wines mostly sold in large quantities in connection with the Australian wine trade in England. The chief buyers ask for these full luscious fruity wines, which will continue to command large and increasing sales for many years and grow into favour, more especially if they obtain the opportunity of maturing in the merchants' cellars instead of being sent into consumption while in a green state, or used, as they undoubtedly are in many cases, for dyeing and disguising purposes, or what the merchant incorrectly terms "blending." In the wine trade there is an evolution at work that promises well for the Australian grower. Provided he pays careful heed that none but really sound well-fermented wines are shipped, an enormous market will be opened up to us, and our supplies, so soon as they are ripe for shipment, will be absorbed at paying prices, so that we need have no fear on the score of over-production and a glutted market. Much depends upon our own efforts in order to achieve the consummation of our desires; there must be no halting or resting till the evils which now beset us are cleared away.

I would here reiterate that wines from Australia, when well made, and even of low alcoholic strength, say from 17 per cent. proof spirit, as well as the heavy alcoholic wines, when carefully made, improve to a wonderful extent on the voyage, and, if fined before shipping, will be found, after being allowed a week or fortnight's rest after arrival, in a highly satisfactory condition. This is the more encouraging, as statements to the contrary have been continually made, no doubt by interested persons, with the object of creating a feeling of discouragement, and preventing independent growers who purposed shipping from doing so.

I would also urge upon intending exporters the urgent necessity of seeing that all casks shipped are thoroughly cleansed and treated before being filled, in order to take out any taint of spirits they may contain or excess of tannin, and which is always present in new wood. It is highly essential that these and every other known precaution should be taken to prevent disappointments and complaints, and in order that success might follow.

In order to demonstrate what matured Australian wines were like to those who wished and had not had an opportunity of tasting them when direct from the grower, and not through the large merchants, when in England I distributed over 100 cases of wines of various kinds, bottled at my cellars, Great Western. My object was to prove that our wines would not only keep, but improve with age. I invited comparison with many of the best wines of the world, and I was thoroughly satisfied with the opinions expressed in regard to them by many gentlemen and merchants who up to the present have not entered into the trade. They assured me that if such wines could be shipped largely and regularly, and sent forward in the same condition and style, success and better prices would speedily follow. Further, I may say, these gentlemen were prepared to support their opinions by ordering quantities of the same kinds to be shipped from Australia, and thus prove the value of their judgment in a practical way. Mr. J. E. Fells, whom I have already mentioned, purchased the whole parcel of the bulk wine I had shipped, and who wrote to me as late as 22nd March, that although the quantity at the time, for him, was large, he had been so successful in attracting attention to the qualities of the wines, which were highly esteemed, and recommended themselves in sampling, that he asked me to forward him 40 hogsheads (about 2,500 gallons), by the next mail boat, of dry red and white wines, and another shipment later on. I only mention this in order to support my contention that if the right types are shipped, and good merchants have the handling of them, that the trade will prosper. I am also, by the same mail (22nd March, 1892), in receipt of a letter from Mr. E. Russell Budden, consulting technical chemist, London, and who analysed my wines on arrival, informing me that he looks forward to a great future for such wines as those I had shipped and submitted to him. He further expresses his opinion that the trade was injured at the outset by the introduction into the London market of inferior produce. "Time alone," he says, "can remedy this injury; but growers must take time by the forelock, and not allow things to drift, as at present." Such letters as these are encouraging, coming, as they do, from gentlemen with a knowledge of the trade, and knowing so much of the requirements of the English market; and strongly emphasises all I have said in regard to exercising the most careful heed that the wines leaving our shores are up to the required standard of excellence.

How to Create Trade on a Sound Basis.

Numerous suggestions have been made as to the best means for expanding and placing the Australian wine trade on a broader and sounder basis. But, while there is a consensus of opinion as to the necessity for prompt action being taken, most regrettable apathy is displayed by those interested, who, while willing to take advantage of opportunities when presented to them, do not attempt to make opportunities for themselves, as they unquestionably should do, either individually or by co-operation with other growers and business men of standing. I have discussed this question with gentlemen in England filling high commercial positions, as well as others largely interested in the shipment of wines, and have come to the conclusion that the goal of our ambition might be the safest and easiest gained by the flotation of a strong company of (say) 100,000 shares of £2 each, and £100,000 called up, shares in which should be held by vignerons and others interested here and in England. There should be no difficulty in floating such a company if growers would come to a proper understanding and co-operate for the common good. Such a combination of producers would assure a regular supply of all grades of wines, and the company, when formed, would establish large cellars in Victoria as well as in the other colonies, in which to store their wines until they were sufficiently matured, and ship them only when they were ready for bottling to the principal depôt in England, so that they could go into immediate consumption. A better class of wines would speedily result, as they would be carefully and skilfully blended before shipment, and customers would be able then to confidently rely upon always receiving the same class and character of wines, which, as I have elsewhere stated, is impossible under existing circumstances. The company would absorb all the supplies which might come forward, and an outlet for surplus stocks would be at once provided. It would prove an inestimable boon for vignerons generally, as they would always have the knowledge that there was a market for their produce. One patent reason why the production of wines has not progressed as could have been desired is the cost of holding and storage. Small growers do not care to go to the expense necessary to provide cellars, vats, casks, and all the appurtenances essential to the production and storage of wine on a large scale for years when there is not an assured market. Many there are who would at this moment have had double the acreage they now possess under vines had they been able to dispose of their young wines. If a company was formed on the lines suggested these difficulties would be overcome, and the production of wines would increase marvellously. Hitherto overmuch attention has been paid to the London merchants, Australian exporters overlooking the fact that there are a number of large centres in the United Kingdom with each of which a trade might be opened up independent altogether of the great metropolis. If the wines, on arrival at the central depôt in England, were subjected to careful treatment I have no doubt that an enormous trade would speedily follow. Larger profits would accrue to all concerned if the company was conducted on sound business lines, and higher prices would prevail throughout Australia for wines, and vignerons would be encouraged to pay more attention to their vineyards and cellars, and the result would be the output of much better wines than at present, and which, I am assured, would drive many of the inferior vintages, which have large sales, out of the market. In order that the company might be successful, co-operation among large and small growers would be necessary. The company might enter into an understanding to purchase all their surplus stocks, after

the local demand had been satisfied, at a price to be mutually agreed upon, for a lengthy and specified term of years. The company would then start with an enormous advantage over any house in the Australian wine trade, as in the first instance it would have a large stock to commence with of matured wines which could be purchased under agreement, and after preliminaries were arranged, could be shipped for immediate sale in Great Britain. From these sales profits would accrue at once. In fact, with such a combination, the company would be practically floated as a going concern, and with a tied area of vineyards in bearing of probably 7,000 acres in Victoria, South Australia, and New South Wales, secured for a term of years, and which would represent at least 200 gallons per acre; the company would have command of 1,400,000 gallons of wine per annum. If the company prospered, as it undoubtedly should if equitable and sensible agreements were entered into with the producers, I do not hesitate to say that in a few years, if it was required, the tied area of production could be doubled, and the assured supply total up to the handsome amount of fully 3,000,000 gallons per annum, and which could be even still further increased as demands for our wines in other markets were created. There is much food for reflection in this both for growers and commercial men, offering as it does a wide field for investment, probable large profits, and the constant employment and settlement on the soil of many thousands of our population. The subject has a political importance also that should not be over-looked. It would assist the Governments of the various colonies in meeting the oft-recurring crises in the labour market; it would help materially to swell the revenues, and add largely to the general prosperity of the whole of Australia.

I am willing at any time to assist in the formation of a company on lines somewhat similar to what I have briefly sketched, as I am firmly convinced that it is absolutely necessary that something of this kind should be undertaken, and as soon as possible, to further an industry which promises so much for Australia, and which otherwise will fail to fulfil the magnificent promises of its first inception.

None of the old-established wine merchants on a large scale in the Australian wine trade in England hold, nor, judging by the lines they are working on, do they intend holding, sufficient stocks, as the wines now shipped to England, whether one-year old or five, make no difference; if they can be sold they will on arrival. In some instances they are sent out in bottle direct to the consumer within a month of their being landed in London. Large wine merchants in England insist that the Australian growers should hold stocks until matured; but even if growers could do so the merchants would not give a sufficient increase per gallon to permit of the storage till matured; and, as is well known, the grower does not, speaking generally, want to act in both capacities, but if he can sell readily at fair prices, he prefers to dispose of his young wines; but he expects that the merchant will store them till matured before placing them on the market, which, from my experience, the merchant seldom does. Growers all the world over invariably sell their vintages yearly, and the merchant stores them, or should do so, until they are sufficiently advanced for shipment or for bottling. This is the only practice followed by good merchants who wish to maintain a character and reputation for their houses. But there are others whose greed urges them to practices which disgust the public and brings the Australian trade into contempt. To such an extent have some of the merchants by their haste to make money succeeded in depopularising Australian wines amongst the wealthier classes in England, that in no single instance did I hear of or come across Australian wines at any gentleman's

table during the few months I was in England. I maintain that the better class trade has never been tried or attempted to be opened up on proper lines, and that there is an immense market awaiting development. Such success as Australian wines enjoy in England to-day is due almost solely to an extensive system of advertising. But trade built on a basis of this sort without being flanked by some merit, will enjoy but a brief prosperity; and for the general weal of Australia I should rejoice to see such a scheme as I have suggested brought to a consummation, for then I should feel satisfied that viticulture would progress rapidly and soundly, and that permanent and steady prosperity would reward the efforts put forth.

New fields for Australian Wines.

The question has frequently been asked—"How is it that those engaged in the Australian wine trade devote so much of thought and attention to the English market and its requirements and so little to other countries?" There are, in the opinion of many people who have given this subject earnest attention, many new and important fields awaiting development. China has been frequently spoken of as a probable good market for Australian wines, and the value of the outlet to viticulture in these colonies would be considerable. India and Japan promise to become valuable markets also, so that there is no reason for Australian vignerons to fear that outlets will not be found for the increased production. Up to this time the wine trade of Australia has been slumbering, but the time has arrived when it must shake off its drowsiness and enter vigorously into the work which has been neglected too long already. Not only does an enormous future await us with the countries named, but various parts of Europe and even France—the cradle of viticulture—promises to become a customer for our finer light wines, such as are suitable for blending for champagne; for, notwithstanding expressed opinions to the contrary, I am confident that in several districts of Australia champagne wines can be produced that will compare favourably with the best champagne wines in the world. Such being the case, if these wines were properly introduced to France, and regular supplies were warranted, I am of opinion that a good business could be done. Germany presents a good field for the introduction of our white wines and wines of a full-bodied Burgundy type. I simply touch upon this aspect of the export question to show that we are as yet but on the threshold of the industry, and that we are unable to conceive what expansion it is possible to attain to. Growers and shippers need only bestir themselves a little to open up channels that would absorb all the wines Australia could produce. India, if properly looked after, promises to become a very large market; and as there need be no fear of sufficient supplies of the kinds of wines required not coming forward in the future, as the increased areas of vines planted, and which will be annually coming into bearing, will keep pace with the increased demand, that country should receive careful study and attention, and good results would be sure to follow.

Wine Casks.

Now that the export trade in wines bids fair to become of great importance to Australian vignerons, there is one matter that should receive careful consideration. One of the costliest items in viticulture is, without doubt, that of providing casks, and I would take this opportunity of saying that persons shipping wine should be permitted to import casks suitable for wine free, in place of, and to the number of, the casks exported. That is to say, if a wine-grower ships 50 hogsheads, containing wine, to London, that he

should be allowed to import 50 hogsheads, either new or second-hand, duty free. It is a well known fact that the casks exported from this country to London are distributed to various parts of Great Britain, and that it is impossible almost for them to be again collected and returned to the shipper. The law of Victoria, passed for the protection of coopers and cask-makers, which provides that all new and second-hand casks imported have to pay an *ad valorem* duty of 25 per cent., oftentimes proves a serious hardship to growers, while the provision that where it can be proved that any second-hand casks are returned empties, sent out so that they can be used again in the export trade, a rebate can be claimed, is as a dead letter. The expenses incidental to obtaining the Government stamp on the staves of the cask, and the verification of the marks by the Customs authorities, makes it very doubtful whether it is a saving to claim drawback at all, as for small consignments Customs charges absorb the whole amount, or nearly so. The plan I have suggested would not interfere in the least with the protection afforded to coopers, for it would only be equal to receiving what had been sent away, without being hampered as at present with the Customs. The matter is so important that I would urge the various Vine-growers' Associations of the colony to bring it forcibly under the notice of the Government, and to enlist the sympathies of their representatives in Parliament in the movement, which, if successful, would remove yet another hindrance from the path of progress. There is another phase of the question that should be borne in mind. While there is an *ad valorem* duty of 25 per cent. on casks and staves imported into this colony, staves are admitted duty free into South Australia, and in New South Wales there is no tax on either cask or staves. From this it will be seen that the Victorian vigneron is put into an uneven competition in the trade with England, even with his neighbours. How this can be reconciled with a professed policy of fostering the industry baffles comprehension, and I trust that the handicap will be removed as soon as possible, in order that the export trade may be facilitated.

Value of Exhibitions.

The value of exhibitions was clearly shown by that held in London in 1885–6. Up to that time Australian wines had received but scant attention from the merchants and connoisseurs, and in despite of the best efforts of the exporters the indifference and apathy which existed could not be removed. The knowledge of what kind of wines Australia could produce was first practically and effectively conveyed to the British public on this occasion. and was brought prominently under my notice while in England. High encomiums were passed upon several of our vintages by experts and gentlemen possessing a wide experience and unchallengeable judgment, and the popular verdict was that if wines of such a character as many exhibited and sold during the exhibition were shipped from Australia in any quantity, and further supplies of the same grade could be relied upon, the wines had a great future before them, and commercial relations with the United Kingdom, as well as with other countries, were capable of a wonderful extension. Proper advantage of the opportunities has certainly not been taken as yet, but the time is now ripe for growers to assert their position and go in for improvement.

The Centennial Exhibition held in Melbourne, 1888–9, lent a still further impetus to the industry, the value of which it would be impossible to estimate. Not only were Australian wines introduced for the first time to thousands of our own people, but direct buyers were brought from England. Prior to the holding of this exhibition but little was known among the general public of our wines, and it was therefore a splendid means

of disseminating a knowledge of the capabilities of the country among all classes of the community.

Knowing what good results have followed from the exhibitions hitherto, it is much to be desired that Australian wines will find a prominent place in the World's Fair to be held in Chicago next year. The time for the closing of entries is now near at hand, and much anxiety is felt by those who have the interest of the industry at heart lest the Government should allow the opportunity to pass without taking advantage of it. The western states of America are making a big bid to secure popularity for their wines in England, and if Victoria fails to have her wines represented at Chicago it may be taken as granted that the enterprising Americans will secure an advantage over Australians, in that they will make their wines known to thousands upon thousands of visitors from Great Britain and the world at large, the majority of whom, perhaps, have but the vaguest idea that Australia is a a wine-producing country at all. The opportunity is one that should be seized promptly by the Governments of the various colonies. The Victorian Government, in pursuance of its policy to encourage the growth of the vine, should not allow such an opportunity as is here presented to pass for making known to the world the capabilities of the country for producing high-class wines without availing itself of it to the fullest possible extent. The financial condition of the colony may not warrant the expenditure of a large sum of money in this enterprise, but something ought to be done to keep the colony to the fore, as it means the increase of an industry of immense importance to the State, the development of other fields, and the introduction of capital which can be well invested, and which would speedily be creative of much labour. We have proved the value of the Indian and Colonial Exhibition, as well as the Centennial Exhibition, as an advertisement for the Australian wine trade, and have found that a large and growing trade has resulted. The Chicago Exhibition will be the largest the world has ever known, and I venture to say that a good representation of Australian wines would be productive of great benefits in attracting population to our shores, drawing attention to our resources, and assisting to open up new and valuable markets.

Viticultural Colleges.

Viticulture in Australia has arrived at a stage in its advancement whence it becomes absolutely necessary to take every conceivable precaution in order that it may suffer no check. Our wines, from this time forward, will enter into serious competition with the produce of European countries, and if success is to crown our efforts we must be prepared to avail ourselves of all the information collected by scientific research, as also to take advantage so far as possible of the accumulated experience of those with whom we shall be called upon to compete. Wine-making forms the most important industry of France, and it is at once instructive and pleasurable to study the means by which it is fostered by the Government. To M. Mathieu de Dombasle belongs the honour of founding L'Ecole de Roville in 1822, which was practically the first institution established in France for the purpose of imparting scientific and practical knowledge in agriculture. From that time forward immense strides have been made in the direction indicated, and the establishment of L'Ecole Nationale d'Agriculture de Montpellier (1872), marks an epoch in the history of agriculture in France. The curriculum of the school embraces agriculture, horticulture, botany, forestry, chemistry, mineralogy, geology, meteorology, silk culture, technology, viticulture, zoology, and entomology. The course of viticulture is remarkably comprehensive, embracing, as it does, the study of the anatomy of the vine—

flowers, leaves, seeds, and stock. Special attention is devoted to the characteristics of the seeds, &c., of the various species of the vine, and pupils are expected to know the names of the vines mostly cultivated by their seed. Hybridisation of vines is practically studied. A special feature in the studies of the pupils is that after they have made themselves acquainted with the structure and habits of the vines they are conducted by the professors over the vineyards connected with the school, in which almost every vine in the world is to be found, and they thus become acquainted with every kind of vine in practical form; they see it grow, learn how to prune it, and the results of the various systems adopted. Excursions are occasionally made over the vineyards in the neighbouring country, and by this means the students are familiarised with the various forms of cultivation. The first term is occupied in acquiring an elementary knowledge of the various subjects to be studied, and afterwards they are introduced to more complex and intricate matters pertaining to pruning, grafting, laying out vineyards, the diseases which attack the vine and the remedies. Careful attention is allotted to phylloxera, and the various types of American vines are subjected to careful scrutiny; M. Foëx, the curator of the viticulture department of the school, having for many years past allotted himself to the investigation of the causes of resistance offered by the American vines to phylloxera, He has already acquired upwards of 400 different types of these vines, and the world is indebted to him for much valuable knowledge on this subject. From what I have said, it will be seen that not only does the school offer magnificent facilities for persons to acquire a thorough knowledge of viticulture, but an increasing inquiry is being made into the laws which produce the effects with which we are already familiar. The instruction imparted to students embraces everything, from the laying out of the vineyard to the final treatment of the vine; and as the school is largely patronised, it may be readily understood that French vignerons are in a much better position than we are in this country in being able to obtain thoroughly competent men. I had also the pleasure of visiting the School of Viticulture at Conegliano, Italy, with which I was much impressed. Everything in connection with this institution is so complete—the instruction given to students is so thorough—that I am inclined to think that it holds the foremost position among similar establishments in the world. Unlike Montpellier, viticulture is studied at Conegliano to the exclusion of allied industries, and to it is largely due the awakening prosperity which is cheering the hearts of Italian vignerons to-day, as well as assisting materially to build up the revenues. The faults in the Italian wine trade, which at one time threatened to almost totally overthrow it, are being rapidly removed; and the Italian Government has been quick to perceive the national importance of a school where those interested in wine-making may learn all that is necessary to profitably and successfully produce a good and marketable article. If, then, the two schools of viticulture I have mentioned are doing such excellent work in Europe, surely there is urgent necessity for the founding of a similar institution in this country, where many of those engaged in the wine-growing are novitiates, possessing at best but a rudimentary knowledge of the processes involved therein. As the industry grows the want will be more and more accentuated, and the loss, I am inclined to think, which will result from ignorance, will soon be greater than that of founding a school on the lines indicated. Such are the proportions which viticulture has already assumed in this country that careful heed should be given to provide proper outlets for the wine produced. The Government by its offer of liberal bonuses to encourage vine-planting has

committed itself to the task of placing the wine-growing industry on a firm and satisfactory basis, and unless provision is made for disposing of the increased supplies the State policy will prove a serious injustice to the older pioneer vignerons, who, unaided, have succeeded in overcoming the many difficulties that confronted them, by encouraging others to enter into competition with them. The wines produced in Victoria, as well as most parts of Australia, that have been proved, are of such a quality that if they are properly treated will command a market without much difficulty. But it is well known that there are a great many people engaged in the industry who do not understand how the wines should be made, and to such the founding of an experimental school on the lines of Montpellier or Conegliano would be an immense advantage. Lack of experience in fermentation and other essential matters has, without doubt, much to do with the low prices ruling for many wines shipped, as well as other causes referred to. But once a sound knowledge of the growth of the vine and the manufacture of wine is practically obtainable, and the necessary information is disseminated amongst growers, all this will be altered, and Australia will have no need to fear competition with any other country. One important result of the establishment of a viticultural college would be that expert labour would soon be available, and vignerons taking advantage of this would find their wines assuming a better position in the market, and, what is of importance also, their vineyards and cellars would be better and more economically managed. The advantage of such a school would soon be recognised, and in all likelihood would be self-supporting, as not only would there be the fees of the students to rely upon, but after a time the vineyard belonging to the institution would be a source of profit, and more particularly as the practical training given would necessitate the performance of a great part of the work by the students, who pay liberally for the privilege of doing it. The proportions of viticulture are becoming so great, and its importance, from an industrial point of view, so generally recognised, that the State would earn the thanks of the whole community if it established colleges that would render the accomplishment of these things possible. There is one other matter that the Government might undertake with a certainty that the act would be fully appreciated. Up to the present the efforts put forth to instruct vignerons in the kindred subjects of wine-growing and wine-making, by the establishment of a Board of Viticulture and the employment of experts, have proved in a great measure abortive; certainly no benefits commensurable with the expense has resulted. The visits of the experts in the service of the Department of Viticulture have in many cases been paid at times when it is impossible to impart any really practical information, and, moreover, the visits have been of such a short duration—flying visits, so to speak—that what good might have been done was but partially accomplished. I am conscious of the fact that valuable service has on occasions been rendered by the experts, particularly to intending planters, as well as in cellar work and the treatment of wines. The system errs in that it falls short in its mission. Young vignerons stand in sore need of advice and counsel during the vintage, as also during the pruning and disbudding season.

If distinct experimental schools were founded, and in connection with these were thoroughly trained and capable experts, whose services could be readily availed of in practical form during those seasons, so as to clearly demonstrate what was required to be done, and how best to do it, an immense good would result, and the industry would be relieved of much that has a tendency to retard its progress to-day.

Phylloxera.

Volumes might be written of the ravages of the phylloxera pest, and, bearing in mind the devastation which it has caused in Europe and in this country, the importance of understanding how to cope with it is of the highest importance. The phylloxera, it has been satisfactorily ascertained, came originally from the United States, where it was first discovered in 1854 by Mr Asa Fitch upon some vines in the State of New York. In 1869, M. J. Lichtenstein, of Montpellier, first hazarded the opinion that the phylloxera, which was attracting much attention in Europe, was identical with the American leaf-gall louse. This opinion was afterwards fully affirmed by several scientists who devoted great attention to the subject. It was not until 1863 that the disease began to develop any very alarming symptom, but such has been the alarming increase since that time that M. François Bernard calculated that vineyards in France covering 1,000,000 hectares (2,470,000 acres) have been totally destroyed by it, and that 200,000 hectares (494,000 acres) in addition are doomed to a like fate. Various specifics have been used to check the inroads of the scourge, chief among which has been the planting of American vines or American stocks, on which are grafted the French vines. These measures have been attended with some success, as the wine crop, which, from an average of 1,200,000,000 gallons prior to the advent of the phylloxera, had fallen to 600,000,000 gallons in 1885, rose to 800,000,000 gallons in 1889. Generally throughout France reconstitution of the old vineyards is rapidly increasing, and, if it continues, in a very short time France will have a greater extent of land under vine cultivation than it has ever had. In 1888 the American vine, for purposes of grafting, had been planted in 22,260 acres only. This had increased in 1889 to nearly 750,000 acres. The vigorous and ligneous roots of certain varieties of the American grape vines have been found impervious to the attacks of the insect, and have flourished in vineyards where all the other vines perished. There is no longer any doubt that phylloxera is indigenous to America, but strange to relate, although found on the wild vines, it is very doubtful if such wild vines in a state of nature are ever killed by it. There is a lurking fear in the minds of French peasant proprietors that, although the vineyards which may be reconstructed in the manner stated would give an increased yield, the quality would be inferior; but I consider that the quality will be equally as good as from the old Bordeaux stocks. In the champagne region where the phylloxera has made its appearance strenuous opposition is shown to any of the methods named, the smaller growers contending that if American plants are introduced there can be no more "French champagne." From the mass of evidence which has been collected on this subject it appears to be conclusively proved that in the phylloxera-resisting vine the world has a remedy for the scourge which at one time threatened to ruin an industry which, in France at any rate, would be a most fearful catastrophe. I need not do more than make the merest mention of the precautions taken in Victoria to combat the disease, but it would seem that the experiences in Europe point a moral which it would be well for us to take to heart. I would suggest that the Government should establish a vineyard or nursery in some isolated position of the varieties of American vines known to be phylloxera-resisting from seeds. This could be considered and managed as an adjunct to the college which I earnestly hope will soon be established. In the event of the pest again making its appearance vignerons would have the satisfaction of knowing that they could obtain rooted vines or cuttings of the kind referred to to replace those destroyed. In the vineyards connected with the school of Montpellier I was

shown vines literally covered with phylloxera, and yet they were thriving well and gave no indications that they suffered at all so far as the yields of grapes were concerned. I would urge, in view of the widespread ruin and the check the industry would receive if ever phylloxera appeared again on a large scale, that pressure should be brought to bear on the New South Wales Government to take immediate and more urgent measures to uproot and destroy all vines in the district affected in that Colony, and that it should be quarantined for a number of years until it was proved beyond doubt that the disease existed there no longer. If the same practical measure had been resorted to as was the case in Victoria the dreaded disease would not exist in New South Wales to cause alarm in the minds of growers generally as it does to-day.

Scarcity of Competent Labour.

The necessity of employing competent labour in our vineyards and cellars is pressing with greater weight upon vignerons to-day than on any previous occasion. The old notion has been exploded that any class of labour is good enough for gathering the vintage and converting the grape juice into wine. Those expert in wine-making are cognisant of the fact that the real work commences when once the wine enters the cellar. After fermentation comes the processes of racking, fining, and blending—all of them matters that the ordinary labourer could not be made to understand without a wonderful deal of trouble and probable loss. Successful wine-making depends upon the careful, cleanly, and skilled performance of every detail connected with it. The scarcity of competent labour gives emphasis to the necessity of establishing colleges or experimental schools, where our youths might receive a theoretical and practical training in vineyard and cellar work. A knowledge of the rudiments of chemistry, if not a qualification absolutely necessary to those engaged in the production of wines, is at least most useful, and assists the possessor to more intelligently discharge the multifarious duties connected therewith. Competition in wines, as in most other things nowadays, is keen, and therefore, in order to command success, in addition to quantity it is essential to have quality also. It is not affirming more than is absolutely the truth when it is asserted that Australia will, in the course of time, be in a position to supply wines the quality of which must command attention even when compared with some of the rarest vintages of the most famous vineyards of Europe. The delicacy of bouquet and excellent character of many Australian red and white wines when brought under the notice of acknowledged connoisseurs had come as a revelation to them. Growers are becoming more expert in handling their wines, and in developing the latent features which they are known to possess; but the difficulty, as stated, is to obtain the services of men who have a sound knowledge of the wines, and who understand the treatment which various sorts of wines should receive in order that they may develop the characteristics that constitute their real value. An aptitude in Australian growers to learn, and a ruling and anxious desire to understand the secrets of wine-making has been productive of much good, and to these causes may be attributed that modicum of success which has recently attended their efforts; but we have much yet to learn before we can expect to attain that degree of excellence enjoyed by old continental growers.

Grape Brandy.

I have dealt at considerable length with the urgent necessity of purging the wine trade of the vicious practices which so very largely exist, and, while I have emphasized the disastrous effects produced in England, I am aware

that matters are not as they should be at home. Strenuous measures are urgently needed to prevent the shipment of bad or inferior wines, otherwise all hopes of the successful establishment of a large trade with Great Britain will be doomed to disappointment or, at all events, unnecessarily delayed. Such wines as were considered unfit or unsuited for shipment could be profitably utilised for distillation.

Sufficient attention has not been given to the manufacture of grape brandy, and I most heartily concur with those who affirm that this is an auxiliary of viticulture that will eventually become very important. Messrs. Joshua Brothers, at their Port Melbourne distillery, have successfully demonstrated the practicability of establishing a large export trade in brandy. Samples of their brandy submitted to experts have been highly spoken of, and the firm has been moderately successful in finding a market outside the Colony. A very wise policy was adopted by this firm in the initial stage of their export trade, viz., they determined that all casks exported should be branded "Victorian Vineyards Brandy," so that the English trade and consumers might be informed from whence the brandy came. That the successful establishment of this industry will prove an immeasurable boon to viticulturists it is needless for me to say. But the aspect of the question to which I would draw particular attention is that wines which might be condemned, once a proper system of supervision is established, could be utilized for distillation. The grower would receive a fair price for his produce, whereas if he were allowed to ship it it would assist in bringing the wine trade still further into disrepute, and would tend to lower the prestige of Australia as a wine-producing country in the minds of the British public. The decadence in the production of grape brandy is universally regretted. The demand for some time past has been in excess of the supply, and I am strongly of opinion that the time is most opportune for Australia to come forward and make a bid for success. However considered it seems to me that brandy-making should become one of the most important adjuncts to what has already become a most powerful factor in the employment of labour and the production of wealth in these latitudes.

It must not be forgotten that many interested parties in England are jealous of our being able to produce wine at all, and are ready at all times to decry the produce of Australia. This is an additional reason why we should be careful to ship no wines that are likely to afford an opportunity to our would-be detractors. I am aware that faulty wines have gone forward from this country to large merchants in England, who buy at distillation prices for the purpose of supplying what they call their cheap wine trade, and it is this class of trade chiefly that serves to bring Australian wines into contempt amongst the English consumers. If distilleries were firmly established here the wines referred to would command good values for distillation, and the credit of the Colony would be saved. Until that time arrives the grower will continue to sell for what he can obtain to any one willing to buy, regardless altogether of consequences. It is the type of wine in question which is to be found in all parts of Great Britain. They have probably been "restored" in the manner I have already described; but they are a standing disgrace to the colonies, and incalculably hurtful to the better class of trade we wish to see established. Once distilleries are properly started in this country the loss resulting from the shipment of inferior or bad wines will be reduced to the minimum, and thereafter the English merchants will be compelled to have resort to other and, I trust, better measures, and buy and sell only good wines of such a type that it will redound to our credit, and restore and create a confidence that will thenceforward guarantee a good and lucrative market.

The Export of Fruit.

ADVICES received by the Department show that the London fruit merchants still maintain a lively interest in the question of exporting fruit from Australia. At the suggestion of the Department several firms have expressed their willingness to forward sample consignments to illustrate the systems of packing adopted in Europe, and more particularly the mode of packing grapes shipped from Spain. Arrangements were also made to obtain the latest hints as to the conditions of the English markets.

With reference to packing, Messrs. Knill and Grant, of London, forwarded per "Orotava" a barrel of grapes which had been shipped from Almeria in Spain in the beginning of October, leaving England as above mentioned on 3rd November, 1892. Special arrangements were made to have the grapes kept in a temperature of 40–45 degrees throughout the voyage to Sydney. The following report by Mr. George Valder, in whose charge the Departmental cold storage experiments have been placed, shows the result of the shipment:—

"The barrel of grapes was received by the Department on Friday, the 23rd December last. It was taken down to the Country Milk Company's stores, and was stored in the butter chamber (over the holiday period) until the following Wednesday; during this time the chamber was kept at an average temperature of 41 degrees Fahr. The barrel was then opened at the offices of the Department, and on examination the following particulars were observed. The grapes were open to public inspection on Wednesday, Thursday, and Friday, the 28th, 29th, and 30th December last:—

"The barrel is what is known on the London fruit market as a 'half-barrel.' It measures 16 inches deep, is 15 inches in diameter at the top and bottom, and 16 inches in diameter in the middle. When packed it holds about 50 lb. of grapes. The staves are made of well-seasoned wood, and they fit very closely together, in fact, when full, the barrel is almost air-tight. The hoops are made of wood, and are similar to those used for the barrels in which currants are packed.

"The cork-dust in which the grapes were packed is rather a coarse sample, but from its light spongy nature, and freedom from dust, it is evidently very suitable for packing this class of fruit. The cork-dust was freely shaken between the berries, and the whole then firmly pressed down, and yet the total weight of cork-dust used in the barrel was only 5 lb. 10 oz.

"In the London and other European fruit markets I have often examined consignments of Spanish grapes, and in comparison with those shipments I should say that the present sample is only a very ordinary one of the Almeria grape.

"The grape is white, rather coarse, with a very tough skin, and the berries are very free on the bunch. Many of the bunches had evidently been cut before the fruit was quite ripe, and as a consequence it was found that the stems were quite rotten. In other bunches, which had been cut when the

fruit was ripe, the stems were quite dry and wiry. The condition of the fruit was, on the whole, very satisfactory, as the berries were quite plump and fresh, and less than one per cent. of them had rotted. It was found that where a berry had rotted the moisture had been absorbed by the cork, and on examination of a number of the berries adjoining those that had rotted they proved to be perfectly sound."

The following "latest hints as to markets" were kindly forwarded by Messrs. W. N. White & Co., of Covent Garden, London, dated 11th November, 1892, to whom Australian fruit-growers are greatly indebted for advice and assistance :—

"The outlook for your apples during the coming season is much better than it was a month ago, for we were then under the impression that America and Canada had very large crops, and that owing to the extent of those crops they would be able to send their goods here till late in the season. We have reason now to alter that impression, as, notwithstanding the large supplies in Canada (some 3,000,000 barrels, or 9,000,000 bushels), shipments will not be great, as the fruit has become more or less wormy, in consequence, we believe, of the trees not being washed so much this season as they have been other seasons, and so will not keep. So on this we take it, there will be a good opening for your country after the middle of January next.

"We understand that a large lot of cork-dust has been shipped to your place this season for the packing of grapes to come forward to this country next year. We ourselves have shipped some to the Cape. Prices are equal to £6 per ton, f.o.b., Lisbon. The dust is packed by hydraulic pressure into bales, in order to reduce the size. We do not think that barrels would be of any use to send to your country for packing grapes in, as we take it that small packages of about 20 lb. would realise more money here than barrels, because both small and large customers purchase them more readily than they do the barrels, as they are more useful. Again, small packages do not take up so much room in the refrigerating chamber as barrels, as they can be conveyed at per ton measurement. All these things must be taken into account.

"In packing grapes in these cases, care should be taken that not a single berry touches the wood. Not only should sufficient dust be placed *around* the grapes to keep the berries away from the wood, but, if possible, *the dust should be well shaken into the bunches*, so as to keep the berries from touching one another. If this advice be followed, the bunches will arrive here in thoroughly sound condition, with the berries unbroken.

"In conclusion, we may remark (and this perhaps is the most important) that *the grape should be sufficiently seasoned when cut*, so that on arrival here the stem is in a wiry condition. If cut green, the stem rots, in consequence of the flow of sap to the berry; and if cut too ripe, the grape, on arrival here, will fall off the bunch. You will see from this that your people have to consider two things :

(1) The packing of the grape.
(2) The time of cutting the same.

"These are most important, and should be well looked after."

Poultry.

Fowls on the Farm.

From the Melbourne Leader, 30th July, 1892.
[By "our Agricultural Reporter".]

In one's talk with the average farmer you find it difficult to "get him down," as he considers it, to any serious consideration of the smaller products of his industry, such as, for example, the keeping of fowls in a systematic way as an important adjunct of farming operations. There is nothing surer, however, than that farming does not pay by confining the operations to one leading line of production, but by a well ordered combination of a number of what separately may be called minor things, but which collectively amount to important contributors in connection with the general annual revenue. Amongst these nothing pays better, when properly looked after, than the poultry on the farm. Take, for example, eggs at their present price in the aspect of their money value to those who have them to sell. No doubt it is a fact that eggs are scarce in the winter, but that is one of the matters for arrangement and management so as to have a supply at a time when they are so valuable; just as the dairyman who can put fresh butter on the market at a time when others cannot is the man who gets the advantage of the high prices and makes money. The export trade in butter has opened a remunerative outlet for that commodity at the season when we have a glut here; and the fact that our glut period is the season of scarcity at the antipodes happens advantageously for us. We have yet, however, to go further forward, and so manage, by timely green fodder crops, and by ensilage, together with a necessary ordering of the milking herd, to have a regular supply of milk all the year round. And so with the management of the poultry. When it is remembered that the United Kingdom has to have her home supply of eggs supplemented by importations amounting to £3,000,000 worth annually, and that our glut period is the season when eggs are as dear in London as they are here now, it will be seen that an important trade presents itself in this direction, after we have succeeded in meeting our own home demand. We cannot, however, so far, supply our own requirements, as last year, notwithstanding an import duty in our favour of 2d. per dozen, eggs to the value of £23,000 had to be imported from the adjoining colonies.

There are a few places in the Colony where poultry are raised as a special business, but it is as a portion of general farm management that the keeping of fowls ought to have a distinct place. As a general rule the fowls on the farm are reckoned as an unimportant affair, and in no direction is it so difficult to ascertain, with any degree of definiteness, what are the monetary results. In the older countries, where these subsidiary items of management are given careful attention to, you can get the farmer to figure on them, and

no doubt the time will come when the importance of these smaller, but none the less important, contributory agencies of the farmer's establishment will receive their proper consideration here also. Speaking at a recent farmers' conference in Canada, one farmer who had discovered how much money there was in fowls said: "It is one of the few products of the farm from which the farmer can at all times realise some ready money. It is the only investment known to the small capitalist that will pay him up to 500 per cent. on his outlay, and not ruin him if he loses his entire stock. It is the only pleasant and profitable occupation that can be engaged in by man or woman alike with equal chances of success. Few people realise the enormity of the demand. It is an industry that is yet in its infancy. The supply cannot easily exceed the demand." Another of the speakers said: "Farmers as a class do not give any special attention to poultry raising, ignoring it as of no consequence, and rather beneath their dignity as freeholders, while it has been demonstrated by practical men in our own neighbourhood that there is more profit in a flock of 100 fowls properly handled than in 100 acres of grain at average prices. Jas. Rankin, who began as a farmer, but is now solely engaged in the poultry business, claims a profit of 28s. per fowl with the aid of his incubators. Mr. Thos. Graham asserts that he has made more money out of 200 hens than he did out of ten cows; while in some of the mountainous counties there are many farms on which people are toiling year after year to gain a living from unproductive soil, while such farms have every advantage for successfully growing ducks, geese, turkeys, and chickens." It may be said that in relation to the average Victorian agriculturist, poultry occupies the position of an undeveloped source of income. It may be safely asserted that nothing about the farm will, with proper management, return so large a profit. It is a department that will utilise what otherwise would be waste, and give a remunerative return for it, representing as it does first, the egg, which is always as good as cash when required; second, the young, which are revenue producers in three to five months; third, the value as a meat product; and fourth, the value in producing the most valuable class of fertiliser. To enter elaborately into all the points connected with successful poultry management cannot, of course, be attempted within the bounds of a newspaper article, and the object is at present to direct attention to the value of the industry, so as to beget a desire for further details, and that being established, the supply of the needed information can follow as required. There may, however, be summarised a few leading conditions among the essentials to success.

With respect to house accommodation, elaborate and expensive buildings are not a necessity, so long as the requisites are met as to the fowls being kept dry, fairly warm, and well attended. A summary of leading rules would include:—(1) Do not inbreed; (2) supply the fowls, if closely confined, with what they are used to when running at large, such as gravel, lime, a dust-bath, and occasional supplies of green stuff; (3) keep no hens over two years, because after that age they moult so late as to eat the profit before they lay; (4) select the best kinds to breed from, and so secure a good laying strain; (5) watch closely for the hens that do not lay and have them killed; (6) save all table scraps and kitchen waste to be mixed into a hot morning meal; (7) keep the hens busy by scattering straw or leaves about their run, and throwing their grain feed into it, but do not feed too much; (8) learn how to manage the poultry department with as much care as any other part of the farm business, and keep a record of expenditure and receipts, so as to ascertain the amount of profit. Hens in confinement should not be too crowded. It is better to divide them into small groups,

the result of the best experience being that more money can be made out of twenty separated than double that number crowded. The average house space to a hen should be from 4 to 6 feet of floor space, and from 6 to 8 feet in height. The question is often asked by beginners in poultry-keeping as to what is the best food to give, and among those in Victoria, who make a specialty of the business, great stress is laid upon this important matter as an essential of success, so much so indeed, that many conserve their particular methods as secret to themselves. That food must have a great influence upon the health of the fowls goes, of course, without saying, and no doubt mistakes are made by those who do not consider the different conditions, as between fowls at liberty and in confinement. Fowls with a free run, live largely upon worms and slugs, and animal food may be taken with plenty of exercise, which would otherwise breed disease. Where eggs are to be produced, many elements are needed, chiefly albumen and oil, so that a well-balanced food is required, but for killing purposes it is best to supply food containing the flesh or fat forming constituents in largest proportion. Barley, one of the commonest grains given to poultry, is most suitable for rearing chickens, or for egg production, its fat and flesh forming constituents being in small proportion to those promoting warmth. Oats may be regarded as the best balanced of all the grains, while the husk forms about 20 per cent. of the whole, so that it is an excellent food for layers, if the oats and husks are bruised up together. Oatmeal, on the other hand, being devoid of the husk, is more suitable for fattening.

Wheat, containing as it does, 8 per cent. of fat, 12 per cent. of flesh forming, 2 per cent. of bone making, and 70 per cent. of warmth-giving properties, with very little husk, can be recommended as one of the best winter foods for general purposes, although it is not suitable for fattening. The small wheat or screenings is better suited for poultry food than the first-class quality of grain, owing to being richer in the flesh-forming matter. Maize is essentially a fattening food, and its exclusive use is apt to do harm by promoting internal fat to such an extent as to check laying, and if long continued, tends to induce disease of the internal organs and apoplexy. It is, however, an admirable fattening food, but when used for this purpose should be ground and swelled with scalding water, and fed in alternation with whole maize, or some other grain. It is very good for feeding whole to all kinds of poultry for the meal given late in the day, as it digests slowly and keeps them warm during the night. Maize or maize-meal should only be given to laying fowls in cold weather, and even then ought to be mixed with three or four times its bulk of other kinds of grain, and it should not be fed too freely to poultry in confinement. Buck wheat is one of the best of foods for laying fowls, but very poor for fattening; while all kinds of pulse, such as peas, beans, and tares, owing to the excess of flesh formers in their composition, as well as to their stimulating action, should not be fed alone, but as a mixture with other foods. Bone meal, although not a poultry food in itself, is most useful for mixing with such foods as are deficient in bone-forming substances. For chicken rearing it is invaluable as a preventive of leg weakness. If the fowls are situated so as not to obtain insects freely, a little meat may be given, but not otherwise, and in wet or cold mornings a little stimulating powder is helpful, but on no account should this be given when the weather is warm and dry. Green food is very essential, and an occasional supply of cabbages will be found beneficial, even should the grass run be extensive. As to system in the times of giving the food, a good general rule that may be observed is—first, a meal of soft food mixed with boiling water early in the morning, the sooner after the fowls leave their

roosts the better; second, a handful or so of grain in the middle of the day; and third, a good feed of grain about an hour before roosting time in the evening. Fowls of all kinds and ages should have access only to pure water. Farm yard drainage, water from the sink, or unclean water of any kind, are all unwholesome and promotive of disease. Stagnant water of any kind is bad. The fowls should always be supplied with fresh pure water, and the drinking vessels should be easily accessible at all times, and kept scrupulously clean. Another important point that must not be forgotten is that as material is required to form the shells, there must always be a supply of old mortar, broken oyster-shells, lime and gravel, the last being specially necessary to assist the fowls to digest their food. These may be taken as among the leading points to be attended to in carrying out the general object of keeping the stock in the best of health and condition; and the farmers who are attending to these main rules and are housing their fowls well, and feeding them as systematically as they do the other stock, are those whose experience can be quoted in support of the assertion that no other adjunct of their operations pays them better.

Notes.

By the Sub-Editor.

During the hot months an occasional tonic is very useful in keeping fowls in healthy, active condition. There are many mixtures of an elaborate character which are doubtless excellent, but our object is to recommend what is most easily obtainable even in remote districts. Probably the tonic which most nearly complies with this requirement is sulphate of iron, mentioned in the *Sydney Mail* of 5th November last. Purchase at the chemist's half a pound of sulphate of iron crystals, and a very small quantity of sulphuric acid. To one gallon of water first add sixty drops of the sulphuric acid, and then the half-pound of sulphate of iron. When this is thoroughly dissolved bottle off, if possible in a spirit-jar, and cork tightly. Add about 1 ounce of the solution daily to each gallon of the drinking water. For immediate use add to the drinking water about three drops of acid and a piece of sulphate about the size of a cherry. It is also a good plan to add a fairly strong dose of the tonic to the soft food during the moulting season, say four or five times a week. Sulphate of iron is somewhat astringent in its operation, and it is therefore necessary to see that the fowls do not become too costive, a result which is more likely to happen when the birds are kept in a confined space. The sulphate of iron crystals should be kept perfectly air-tight to prevent deterioration.

Every poultry-keeper should grow sunflowers. A few of the seeds fed occasionally to the laying hens will have a most beneficial effect on their egg production. The large Russian variety will be found most satisfactory as being a prolific and reliable seeder.

It is essential that this season's chicks should have one meal of bran and pollard daily all through the summer. Advantage should be taken of this soft meal to give any youngsters having a tendency to leg-weakness a little ground bone. There is an extremely good bone-meal now obtainable from Spratt's Sydney agent, which will be found most effective. It is clean and entirely without any unpleasant smell.

There is often considerable difficulty in feeding chicks apart from the full-grown birds, especially where all have their liberty. A cheap and useful feeder may be knocked together with soft wood, and either laths or wire. It should be about 8 feet by 8 feet, and can be made by simply nailing the

four 8-foot lengths on four legs about 18 inches high, and then filling in with laths sufficiently close to prevent full-grown birds getting inside. The food can be placed on boards or trays in the middle, and the youngsters will soon get into the habit of going inside when they are hungry. The timber may be quite light, as there is practically no wear and tear.

Always keep the fowls drinking water where ducks cannot get at it. The fountain may be placed on a box about 18 inches to 2 feet off the ground as the ducks will not attempt to fly up even this height. It is better, if possible, to keep fowls and ducks apart, especially at feeding time.

The mention of ducks reminds me that it is of great assistance in fattening to give them their grain in water. Just throw the quantity you intend giving them into a good-sized tin dish or iron trough, and see how they enjoy the task of getting it out. It will be seen that this is a very natural way for water-fowl to take their food.

A very cheap and effective trough may be made out of an old piece of corrugated roofing iron. Just turn up the ends, and grove out a couple or three blocks (according to the length) for it to rest in. Never forget to keep these troughs clean. Dirty water is no better for ducks than for any other birds.

In order to preserve eggs for a good market, the following results of a prize competition at the last Birmingham Exhibition are worthy of note:—The first prize was given to eggs which had been stored in a solution of 4 lb. of lime in two gallons of water in an earthenware jar. The solution should be stirred occasionally for two days, and the eggs put to within 3 inches of the surface. The next most satisfactory method was simply placing the fresh eggs in common salt, and keeping them in a dry place. Other samples were rubbed over with melted suet, beeswax and oil or lard, and although they were good, none were so successful as the two methods first described.

Sulphate of Ammonia in Potato Growing.

In the spring of the present year, the *Standard* newspaper—in their periodical article on "Home and Foreign Agriculture"—made mention of a method of treating seed-tubers practised by a French grower, to the following effect:—

"Experienced potato-growers will be apt to smile sceptically when they are informed that they can easily grow 42 tons per acre. Mr. Warburton, however, writing from La Rochelle, assures them that a French grower finds no difficulty in achieving so wonderful a result. This very successful producer selects the best and soundest of seed-tubers of medium size, and plants them whole, while he cultivates deeply and manures liberally. So far there is nothing at all out of the common; but the grower also immerses his seed-tubers for twenty-four hours in a solution of 6 lb. of sulphate of ammonia, and 6 lb. of nitrate of potash (saltpetre) in 25 gallons of water, allowing the tubers to remain for another twenty-four hours afterwards, so that the germs may have time to swell. It is to the increased activity of germination produced by this stimulating bath, that he attributes his enormous return. Perhaps some growers in this country will try the plan, and make known the results. If they get half the crop said to have been produced by the French grower, they will be well satisfied."

We learn that the suggested experiment has been carried out. The Rev. J. J. Milne, of Alleyn Park, West Dulwich, writing under date of the 22nd inst., says that, being sceptical as to the results said to have been obtained from the French grower's treatment, he determined to try it on a very poor piece of ground—viz., an old raspberry bed, which, of course, was trodden hard—and used as seed the small potatoes which remained after planting the other ground, the sets being very small, and weighing from ½oz. to 1 oz. each. The piece of ground was 21 yards long by 5½ yards wide, and the potatoes were planted in ten rows, allowing about 20 inches between the rows, and from 10 to 12 inches between the sets. He planted the seed with manure in shallow trenches, which were very difficult to make, owing to the hardness of the ground; and before planting, in accordance with the instructions given, he immersed the tubers for twenty-four hours in a solution of 1 lb. of sulphate of ammonia and 1 lb. of nitrate of potash in 5 gallons of water—allowing the tubers to remain for another twenty-four hours exposed to the air, so that the germs might have time to swell. They were planted on the 6th of April and were taken up on the 13th of September, and gave a return of 15½ bushels. The soil was heavy clay, which had not been worked for three years; but very few of the potatoes were diseased, and the tubers were decidedly above the average in size. Side by side with the above he planted a well-worked piece of ground, 21 yards long by 15½ yards wide, with good sound tubers of medium size, which gave a return of 30 bushels, very few being diseased. It will be seen at once, says the reverend gentleman, that the seed tubers which were soaked in the

solution gave a return at the rate of 651 bushels to the acre, while the others, though much larger tubers, and on superior soil, yielded only at the rate of 446 bushels to the acre. So that the yield from the former was nearly 50 per cent. more than that from the latter; and he has no doubt that, if the soil in the two cases had been of the same quality and the tubers of the same size, the crop from the former would have been still more abundant. The chemicals cost 1s. 3d. He recommends potato-growers to try the experiment next year with (say) a quarter of their seed, and carefully compare the result with the rest of the crop.

As the department has been asked several times to express an opinion about these results in French potato-growing, the above facts are given for what they are worth. It must be noted, however, that these results can be obtained only from land naturally very rich or well manured. It can be readily understood that this stimulating solution gives a stimulus to the young growth that enables it to develop greater power of foraging for its food. Wheat-growers have found the same benefit accrue from dressing their seed in the same way. The actual nitrogen and potash in the chemical manures employed in the solution contribute but little to the increase in yield, which must, of course, derive its nitrogen and mineral matters from the soil.

Analyses of Commercial Fertilizers.

By F. B. GUTHRIE,
Departmental Analyst.

WITH NOTES BY THE DIRECTOR OF AGRICULTURE.

PHOSPHO-GUANO.

A SAMPLE of manure known as phospho-guano, obtained from the Co-operative Acid and Chemical Manufacturing Company of Alexandria, has given the following results on analysis:—

Water	6·244	per cent.	
Volatile and organic matter...	45·368	,,	(containing nitrogen, 3·220%)
Mineral matter	48·388	,,	
Sand and insoluble matter	3·574	,,	
Total phosphoric acid (P_2O_5)	17·174	,,	
[37·491 per cent. phosphate.]			$Ca_3(PO_4)$
Soluble P_2O_5 (water)	10·054	per cent.	
Soluble P_2O_5 (citrate)	1·757	,,	
Insoluble phosphoric acid (P_2O_5)	5·363	,,	
Potash K_2O	·708	,,	

This, says the Director, is a very useful and quickly-available manure peculiarly suitable for wheat, maize, and grasses of all kinds, citrus fruits, and green crops. With the addition of 4 to 10 per cent. of sulphate of potash, complete manures can be made suitable for any crop and any ordinary soil. The value, according to sample, is £6 14s. 6d. per ton.

ODAM'S FERTILIZERS.

Superphosphate.

An analysis of a sample of Odam's superphosphates, handed to the Department by Messrs. Holdsworth, Macpherson, & Co., the Sydney agents, shows the following results:—

Water	12·824	per cent.	
Organic matter	14·949	,,	
(Containing nitrogen ·252 per cent., ammonia ·291 per cent.)			
Mineral matter	72·227	per cent.	
Total phosphoric acid (P_2O_5)	18·228	,,	(39·791 phosphate)
Soluble P_2O_5 (water)	15·832	,,	(34·611 phosphate)
Soluble P_2O_5 (citrate)	1·102	,,	
Insoluble P_2O_5	1·294	,,	
Sand, &c.	3·587	,,	

Complete Manure.

The following results were obtained on analysis of a sample of Odam's complete manure, from the same source :—

Water	10·012	per cent.	
Organic matter	23·556	,,	
(Containing nitrogen 3·501 per cent., ammonia 4·2 per cent.)			
Mineral matter	66·432	per cent.	
Total phosphoric acid ($P_2 O_5$)	12·568	,,	(27·435 phosphate)
Soluble ,, (water)	10·419	,,	(22·744 phosphate)
Soluble ,, (citrate)	·860	,,	
Insoluble phosphoric acid	1·289	,,	
Potash ($K_2 O$)...	5·479	,,	(8·685 potash chloride)
Sand	7·538	,,	

Specially Dissolved Bone Compound.

The following results were obtained on analysis of a sample of specially dissolved bone compound, from the same source :—

Water	6·403	per cent.	
Organic matter	29·995	,,	
(Containing nitrogen 1·960, ammonia 2·380)			
Mineral matter	63·602	per cent.	
Total phosphoric acid ($P_2 O_5$)	16·533	,,	(36·091 phosphate)
Soluble phosphoric acid (water)	8·737	,,	(19·093 phosphate)
,, (citrate)	2·523	,,	
Insoluble phosphoric acid	5·270	,,	
Sand, &c.	5·703	,,	

Commenting on the above, the Director says the samples are of excellent quality mechanically, and are well up to the guaranteed standard in every case. From the analyses the following are the values, based upon the selling prices of fertilizers offered for sale in the Colony :—

Superphosphate, about £5 12s. per ton; complete manures, £7 16s. per ton; and special dissolved bone compound, £5 12s. 6d. per ton.

As is the case with all other imported manures, the prices are found to be high when compared with the local articles, which are made of the same constituents as those imported, with this difference, however, that as there is little local demand for these waste products—superphosphate, sulphate of ammonia, bone meal, &c.—in this Colony, they must be sold cheap, whereas in England the great demand for them makes the prices higher.

Analyses of Soils.

By F. B. GUTHRIE,
Departmental Analyst.

WITH NOTES BY THE DIRECTOR OF AGRICULTURE.

SHERBROOKE.

A SAMPLE of soil from Sherbrooke, *via* Bulli, has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The geological formation of the surrounding country is Hawkesbury sandstone; the nature of the soil is sandy loam; the nature of the subsoil compact sand; the reaction of the soil is neutral, and its capacity for water 64 per cent. The absolute weight per acre 6 inches deep is 1,875,482 lb.

A mechanical analysis of the soil shows that it contains of root fibres, ·06 per cent.; stones over ¼-inch in diameter, 1·14 per cent.; coarse gravel, more than $\frac{1}{10}$-inch diameter, 7·39 per cent.; fine gravel, more than $\frac{1}{50}$-inch diameter, 7·5 per cent.; fine soil, 83·91 per cent., comprising sand, 59·56 per cent., and impalpable matter, chiefly clay, 24·35 per cent.

An analysis of the fine soil discloses moisture, 9·803 per cent., and volatile and combustible matter, principally organic, 23·708 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consists of: Lime (CaO), ·238 per cent., the general value of which s good, being equivalent to 4,760 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·117 per cent., the general value of which is satisfactory, being equivalent to 2,340 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_3O_5), ·186 per cent., the general value of which is good, being equivalent to 3,720 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·184 per cent. (equal to ·223 per cent. of ammonia), the general value of which is good, being equivalent to 3,680 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·122 per cent., general value of which is satisfactory; ferric oxide (Fe_2O_3) 1·797 per cent., general value deficient; and sulphuric acid (SO_3), ·119 per cent., general value satisfactory; ferrous oxide, 2·823 per cent.

In connection with the foregoing particulars, the special points of value in the soil and mechanical condition and vegetable matter. Its special defects

NOTE.—(*a*) This amount of lime would be supplied in 5,288 lb. of quicklime, or 6,988 lb. of slacked lime, or 9,440 lb. of chalk. (*b*) This amount of potash would be supplied in 4,680 lb. of commercial sulphate of potash, or 19,500 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 14,880 lb. of commercial bone-dust, or 22,320 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 18,400 lb. of sulphate of ammonia, or 22,080 lb. of nitrate of soda.

too much of the lower oxide. Its general character mechanically is very good, and chemically very fair. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are fruit, vegetables, greenstuff, and roots, while it is unsuitable, without special manure or special treatment, for cereals. The manures and treatment recommended for trial are thorough cultivation, to allow air to oxidise the lower black oxide of iron into the red oxide (rust); fallowing and draining would be very useful. For manure, 2 to 4 cwt. superphosphate of lime per acre.

Speaking generally, probably the best manure that can be used will be sub-drainage and constant turning over to the air. Wood ashes and lime would help to sweeten the soil, and a little manure would keep it in good heart.

SUTHERLAND.

A SAMPLE of soil from Sutherland has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The geological formation of the surrounding country is sandstone; the nature of the soil is loam; the reaction of the soil is neutral; and its capacity for water, 36 per cent. Absolute weight per acre, 6 inches deep, 2,512,207 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·08 per cent.; stones over $\frac{1}{4}$-inch in diameter, 1·10 per cent.; coarse gravel, more than $\frac{1}{10}$-inch diameter, 8·91 per cent.; fine gravel, more than $\frac{1}{50}$-inch diameter, 2·45 per cent.; fine soil, 87·46 per cent., comprising sand, 41·93 per cent., and impalpable matter, chiefly clay, 45·53 per cent.

An analysis of the fine soil discloses moisture, 2·596 per cent., and volatile and combustible matter, principally organic, 7·320 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·324 per cent., the general value of which is good, being equivalent to 6,480 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·130 per cent., the general value of which is satisfactory, being equivalent to 2,600 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·054 per cent., the general value of which is fair, being equivalent to 1,080 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·187 per cent. (equal to ·227 per cent. of ammonia), the general value of which is good, being equivalent to 3,740 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·131 per cent., general value of which is satisfactory; ferric oxide (Fe_2O_3), ·887 per cent.; general value deficient; and sulphuric acid (SO_3), ·086 per cent.; general value satisfactory; ferrous oxide, ·470 per cent.

In connection with the foregoing particulars, the special points of value in the soil are nil; its special defects, phosphoric acid and iron. Its general character mechanically is very fair, and chemically fairly good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are summer fruit, greenstuff, grapes, maize; while it is unsuitable, without special manure or special treatment, for roots, strawberries, vegetables, and cereals. The manures and treatment recommended for trial are sub-draining to open soil to beneficial

NOTE.—(*a*) This amount of lime would be supplied in 7,200 lb. of quicklime, or 9,513 lb. of slaked lime, or 12,856 lb. of chalk. (*b*) This amount of potash would be supplied in 5,290 lb. of commercial sulphate of potash, or 21,666 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 4,320 lb. of commercial bone-dust, or 6,480 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 18,700 lb. of sulphate of ammonia, or 22,440 lb. of nitrate of soda.

influence of air; lime, 1 ton per acre, in autumn to break up clay and liberate latent potash; good bone-dust or superphosphate, 4 cwt. per acre, to supply phosphoric acid.

Speaking generally, sulphate of iron finely powdered (1 cwt. per acre) will be very valuable for potatoes and strawberries, if applied in the drills with bone-dust or superphosphate (Sugar Company's No. 2); if the latter manure be used, always apply it in the spring. For strawberries I recommend plenty of mulching with bush leaves, rotten tan, or well rotted stable manure to enable the soil to retain moisture better. With this, and the manures recommended, they ought to do well.

Nowra.

A sample of soil from Forest Lodge, Nowra, has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is sandy loam; the reaction of the soil is neutral; and its capacity for water, 28·2 per cent. Absolute weight per acre, 6 inches deep, 2,738,066 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·08 per cent.; stones over $\frac{1}{4}$-inch in diameter, 20·52 per cent.; coarse gravel, more than $\frac{1}{10}$-inch diameter, 13·22 per cent.; fine gravel, more than $\frac{1}{30}$-inch diameter, 5· per cent.; fine soil, 61·18 per cent., comprising sand, 30·58 per cent., and impalpable matter, chiefly clay, 30·60 per cent.

An analysis of the fine soil discloses moisture, 3·251 per cent., and volatile and combustible matter, principally organic, 5·513 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·221 per cent., the general value of which is good, being equivalent to 4,420 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·116 per cent., the general value of which is satisfactory, being equivalent to 2,320 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·112 per cent., the general value of which is satisfactory, being equivalent to 2,240 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·257 per cent. (equal to ·313 per cent. of ammonia), the general value of which is good, being equivalent to 5,140 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·175 per cent., general value of which is satisfactory; ferric oxide (Fe_2O_3), 2·228 per cent.; general value deficient; and sulphuric acid (SO_3), ·066 per cent.; general value fair; ferrous oxide, 1·046 per cent.

In connection with the foregoing particulars, the special points of value in the soil are nitrogenous matter, its special defects, none. Its general character mechanically is good, and chemically very fair. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are fruit, vegetables, hay, green-stuff; while it is unsuitable, without special manure or special treatment, for no crop suited to the district if properly cultivated. The manures and treatment recommended for trial are: Lime, which would be found very useful, 1 ton to the acre in autumn. Afterwards each crop should get

Note.—(*a*) This amount of lime would be supplied in 4,911 lb. of quicklime, or 6,489 lb. of slaked lime, or 8,769 lb. of chalk. (*b*) This amount of potash would be supplied in 4,640 lb. of commercial sulphate of potash, or 19,333 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 8,960 lb. of commercial bone-dust, or 13,440 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 25,700 lb. of sulphate of ammonia, or 30,840 lb. of nitrate of soda.

Sugar Company's No. 1 manure, 2 to 4 cwt. per acre for vegetables, oats, and green crops; for potatoes, No. 4 manure, 2 cwt. per acre.

Speaking generally, this soil wants plenty of working and opening up to the air, with which small dressings of manure ought to keep it in good heart.

Campbelltown.

A sample of soil from Leumeah, near Campbelltown, has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is clay loam, the reaction of the soil is neutral; and its capacity for water, 46 per cent. Absolute weight per acre, 6 inches deep, 2,153,029 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·10 per cent.; stones over $\frac{1}{4}$-inch in diameter, 0 per cent.; coarse gravel, more than $\frac{1}{10}$-inch diameter, 1·52 per cent.; fine gravel more than $\frac{1}{30}$-inch diameter, 2·5 per cent.; fine soil, 95·88 per cent., comprising sand, 31·62 per cent., and impalpable matter, chiefly clay, 64·26 per cent.

An analysis of the fine soil discloses moisture, 4·723 per cent., and volatile and combustible matter, principally organic, 11·527 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·251 per cent., the general value of which is good, being equivalent to 5,020 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·215 per cent., the general value of which is good, being equivalent to 4,300 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·128 per cent., the general value of which is satisfactory, being equivalent to 2,560 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·241 per cent. (equal to ·292 per cent. of ammonia), the general value of which is good, being equivalent to 4,820 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·267 per cent., general value of which is good; ferric oxide (Fe_2O_3), 4·960 per cent.; general value satisfactory; and sulphuric acid (SO_3), ·107 per cent.; general value satisfactory; ferrous oxide, ·359 per cent.

In connection with the foregoing particulars, the special points of value in the soils are potash and organic matter; its special defects, stiff nature. Its general character mechanically is tolerable, and chemically good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are maize, beans, summer fruits, vines, cabbages, cauliflowers, while it is unsuitable, without special manure or special treatment, for citrous fruits, roots, tender vegetables. The manures and treatment recommended for trial are pipe-draining, 30 inches deep, for fruit-trees and any crops which will repay the expense; liming, 1 ton per acre, to break up the clay and liberate latent (unavailable) potash. Dried blood and bone-dust will give good satisfaction, and improve mechanical conditions of soil.

Speaking generally, draining and liming will deepen this soil and improve its condition for working, its power of retaining moisture and its mellowness, more than any manures; these will be necessary later on.

Note.—(*a*) This amount of lime would be supplied in 5,577 lb. of quicklime, or 7,370 lb. of slaked lime, or 9,960 lb. of chalk. (*b*) This amount of potash would be supplied in 8,600 lb. of commercial sulphate of potash, or 35,833 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 10,240 lb. of commercial bone-dust, or 15,360 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 24,100 lb. of sulphate of ammonia or 28,920 lb. of nitrate of soda.

Thirlmere.

A sample of soil from Lakesland, Thirlmere, has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is loam; the reaction of the soil is neutral; and its capacity for water, 53·33 per cent.; absolute weight per acre, 6 inches deep, 2,210,171 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·04 per cent.; stones over ½-inch in diameter, 1·35 per cent.; coarse gravel, more than $\frac{1}{10}$-inch diameter, 8·64 per cent.; fine gravel, more than $\frac{1}{24}$-inch diameter, 3·12 per cent.; fine soil, 86·85 per cent., comprising sand, 38·18 per cent., and impalpable matter, chiefly clay, 48·67 per cent.

An analysis of the fine soil discloses moisture, 5·848 per cent., and volatile and combustible matter, principally organic, 16·987 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·652 per cent., the general value of which is very good, being equivalent to 13,040 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·197 per cent., the general value of which is good, being equivalent to 3,940 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·106 per cent., the general value of which is satisfactory, being equivalent to 2,120 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·408 per cent. (equal to ·469 per cent. of ammonia), the general value of which is good, being equivalent to 8,160 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·400 per cent., general value of which is good; ferric oxide (Fe_2O_3), 1,177 per cent., general value deficient; and sulphuric acid (SO_3), ·118 per cent.; general value satisfactory; ferrous oxide, 1·100 per cent.

In connection with the foregoing particulars, the special points of value in the soil are potash and vegetable matter; its special defects, rather stiff character, and percentage of ferrous oxide (deleterious oxide of iron). Its general character mechanically is very fair, and chemically, good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are summer fruit, peas, vines, oats, vegetables; while it is unsuitable, without special manure or special treatment, for roots and citrus fruits. The manures and treatment recommended for trial are lime, which will be most valuable in decomposing vegetable matter for the use of the plants, and in setting free potash from the insoluble compounds in which it is now locked up. This ought to improve the soil mechanically, and unlock much of its vegetable and mineral wealth.

Speaking generally, apply the lime, 1 to 2 tons per acre, after ploughing and harrowing. It will descend into the subsoil quite quickly enough. In order to make the green crops as vigorous as possible, a light dressing of Gee's fertiliser (blood and bone-dust), 2 to 4 cwt. per acre ought to pay. Drainage will improve this soil very much for fruit-trees. Constant cultivation, with the aid of lime, will get rid of the injurious oxide of iron.

Note.—(*a*) This amount of lime would be supplied in 14,488 lb. of quicklime, or 19,145 lb. of slaked lime, or 25,872 lb. of chalk. (*b*) This amount of potash would be supplied in 7,880 lb. of commercial sulphate of potash, or 32,833 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 8,480 lb. of commercial bone-dust, or 12,720 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 800 lb. of sulphate of ammonia, or 48,960 lb. of nitrate of soda.

Casino.

A sample of soil from Sandy Creek, Casino, has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is loam; the reaction of the soil is neutral; and its capacity for water, 33·4 per cent. Absolute weight per acre, 6 inches deep, 2,618,328 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·12 per cent.; stones over $\frac{1}{4}$-inch in diameter, 2·70 per cent.; coarse gravel, more than $\frac{1}{10}$-inch diameter, 24·89 per cent.; fine gravel, more than $\frac{1}{50}$-inch diameter, 7·60 per cent.; fine soil, 64·69 per cent., comprising sand, 23·95 per cent., and impalpable matter, chiefly clay, 40·74 per cent.

An analysis of the fine soil discloses moisture, 2·751 per cent., and volatile and combustible matter, principally organic, 6·717 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·181 per cent., the general value of which is satisfactory, being equivalent to 3,620 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·101 per cent., the general value of which is satisfactory, being equivalent to 2,020 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·057 per cent., the general value of which is indifferent, being equivalent to 1,140 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·129 per cent. (equal to ·157 per cent. of ammonia), the general value of which is satisfactory, being equivalent to 2,580 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·109 per cent., general value of which is satisfactory; ferric oxide (Fe_2O_3), ·662 per cent.; general value deficient; and sulphuric acid (SO_3), ·092 per cent.; general value satisfactory; ferrous oxide ·856 per cent.

In connection with the foregoing particulars, the special points of value in the soil are none, its special defect, phosphoric acid. Its general character mechanically is good, and chemically, fairly good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are fruit, green crops, grass; while it is unsuitable, without special manure or special treatment, for grain of any sort. The manures and treatment recommended for trial are that the ground should be well worked to change the deleterious ferrous oxide into the red oxide of iron (rust), and some form of phosphates should be added—Sugar Company's No. 1 or bone-dust—4 cwt. per acre.

Speaking generally, with good bone-dust or superphosphate, as made by Sugar Company, this soil should give very fair returns for grass, hay, and other crops suited to the district; otherwise the phosphoric acid will soon be exhausted by cropping.

Kurrajong.

A sample of soil from Ivanhoe, Kurrajong, has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is loam; the reaction of the soil is neutral; and its capacity for water, 47·66 per cent.; absolute weight per acre, 6 inches deep, 2,290,134 lbs.

Note.—(*a*) This amount of lime would be supplied in 4,022 lb. of quicklime, or 5,314 lb. of slaked lime, or 7,182 lb. of chalk. (*b*) This amount of potash would be supplied in 4,040 lb. of commercial sulphate of potash, or 16,833 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 4,560 lb. of commercial bone-dust, or 6,840 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 12,900 lb. of sulphate of ammonia, or 15,480 lb. of nitrate of soda.

A mechanical analysis of this soil shows that it contains of root fibres, 0·4 per cent.; stones over ¼-inch in diameter, 66 per cent.; coarse gravel, more than $\frac{1}{10}$-inch diameter, 1·77 per cent.; fine gravel, more than $\frac{1}{50}$-inch diameter, ·79 per cent.; fine soil, 96·74 per cent., comprising sand, 50·29 per cent., and impalpable matter, chiefly clay, 46·45 per cent.

An analysis of the fine soil discloses moisture, 3·567 per cent., and volatile and combustible matter, principally organic, 9·222 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·2 per cent., the general value of which is good, being equivalent to 4,000 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·195 per cent., the general value of which is good, being equivalent to 3,900 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·222 per cent.. the general value of which is good, being equivalent to 4,440 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·165 per cent. (equal to ·200 per cent. of ammonia), the general value of which is good, being equivalent to 3,300 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·350 per cent., general value of which is good; ferric oxide (Fe_2O_5), 4·149 per cent.; general value satisfactory; and sulphuric acid (SO_3), ·089 per cent.; general value satisfactory; ferrous oxide, ·506 per cent.

In connection with the foregoing particulars, the special points of value in the soil are potash and phosphoric acid; its special defects, none. Its general character mechanically is very fair, and chemically, good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are summer fruits, vine, peas, beans, green crops, while it is unsuitable, without special manure or special treatment, for none suited to the climate. The manures and treatment recommended for trial are sub-draining for fruit-trees and vegetables. One ton of lime per acre would liberate the insoluble potash and make it available for plants. Superphosphate of lime (Sugar Coy.'s No. 1 or No. 2 manures), should be of great benefit to citrous fruits.

Speaking generally, light dressings of soluble manures should pay in the quality of the fruit, but with proper cultivation and liming very little should be necessary for the first five years on new land.

Byron Bay.

A sample of soil from Rose Vale, Byron Bay, has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is sand; the reaction of the soil is neutral; and its capacity for water, 40 per cent.; absolute weight per acre, 6 inches deep, 2,787,840 lb.

A mechanical analysis of this soil shows that it contains of root fibres, 1·0 per cent.; stones over ¼-inch in diameter, ·0 per cent.; coarse gravel, more than $\frac{1}{10}$-inch diameter, ·0 per cent.; fine gravel, more than $\frac{1}{50}$-inch diameter, 7·18 per cent.; fine soil, 91·82 per cent., comprising sand, 89·43 per cent., and impalpable matter, chiefly clay, 2·39 per cent.

Note.—(*a*) This amount of lime would be supplied in 4,444 lb. of quicklime, or 5,872 lb. of slaked lime, or 7,936 lb. of chalk. (*b*) This amount of potash would be supplied in 7,800 lb. of commercial sulphate of potash, or 32,500 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 17,760 lb. of commercial bone-dust, or 26,640 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 16,500 lb. of sulphate of ammonia, or 19,800 lb. of nitrate of soda.

An analysis of the fine soil discloses moisture, ·612 per cent., and volatile and combustible matter, principally organic, 3·640 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·205 per cent., the general value of which is good, being equivalent to 4,100 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·049 per cent., the general value of which is indifferent, being equivalent to 980 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·031 per cent., the general value of which is indifferent, being equivalent to 620 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·073 per cent. (equal to 0·88 per cent. of ammonia), the general value of which is fair, being equivalent to 1,460 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·080 per cent. general value of which is indifferent; ferric oxide (Fe_2O_3), ·048 per cent.; general value deficient; sulphuric acid (SO_3), ·051 per cent.; general value fair; and ferrous oxide ·00 per cent.

In connection with the foregoing particulars, the special point of value in the soil is its mechanical conditions, its special defects, phosphoric acid, potash, iron, nitrogenous matter. Its general character mechanically is very good, and chemically poor. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are none without assistance, after first crop vines, lucerne, and fruit-trees would do best, while it is unsuitable, without special manure or special treatment, for any heavy crops. The manures and treatment recommended for trial are dried blood and bone-dust, 4 to 6 cwt. per acre, for grass and green crops of all sorts. Wood ashes will improve it, also ploughing in green crops, especially peas and tares, or even weeds, if nothing better.

Speaking generally, it seems very doubtful if it would pay to manure this soil. It would be preferable to give it as much ashes as possible, and a dressing of 6 cwt. per acre of good blood and bones, and lay it down to good grass.

NOTE.—(*a*) This amount of lime would be supplied in 4,555 lb. of quicklime, or 6,019 lb. of slacked lime, or 8,134 lb. of chalk. (*b*) This amount of potash would be supplied in 1,960 lb. of commercial sulphate of potash, or 8,167 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 2,480 lb. of commercial bone-dust, or 3,720 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 7,300 lb. of sulphate of ammonia, or 8,760 lb. of nitrate of soda.

General Notes.

Pomological Committee.

The Minister has approved of the appointment of a Pomological Committee to meet in conference with the fruit expert of the Department, in order to assist him in naming well-known varieties of fruit and seedlings submitted for their judgment. This Committee will consist of three practical fruit-growers of acknowledged ability in their avocations, nominated by the Fruit-growers' Union of New South Wales; three nominated by the Department, and two officers of the Department. It is proposed that there should be about two meetings annually, to be held in the offices of the Department; but the meetings will be convened by the Department when considered necessary. The Committee will be authorised to have models made of any good varieties of Australian fruit, and to name and publish descriptions of any new seedlings deemed worthy of the distinction. The appointments to this Committee are honorary, but travelling expenses will be allowed to members when summoned to meet on this business.

Hawkesbury Agricultural College.

The examinations for the first diplomas granted by the Hawkesbury College were completed at the close of last session. It was thought that, in view of the importance of these examinations, it would be preferable to appoint gentlemen outside the Colony as examiners, and arrangements were ultimately made with the Principals of the Victorian and South Australian Agricultural Colleges to act in this capacity. Professor Lowrie, of the Roseworthy College, South Australia, undertook Chemistry, English, Veterinary Science, and Practical Agriculture; Mr. T. K. Dow, of Longeronong, Victoria, Natural Philosophy, Mensuration, and Arithmetic; and Mr. W. Brown, of Dookie College, Victoria, the Principles of Agriculture, Entomology, and Book-keeping. All the papers were set by these gentlemen, and on their reports to the Minister the diplomas will be awarded.

Crickets injuring Fruit-trees.

Now that the season is approaching when another invasion of crickets (*Gryllus servillei*, Sauss.) may be anticipated, we would refer orchardists to an article on this subject, which appeared in Vol. III, Part 4, page 270. There will be found recommended remedies which have either proved effective, or which are worth trying by way of experiment. In addition to the remedies there given, it is suggested that a mixture of arsenic and sugar, thickened with meal, and dabbed on the stems of the trees, should be tried by way of experiment. A correspondent has forwarded us the following extract from the *Garden*:—

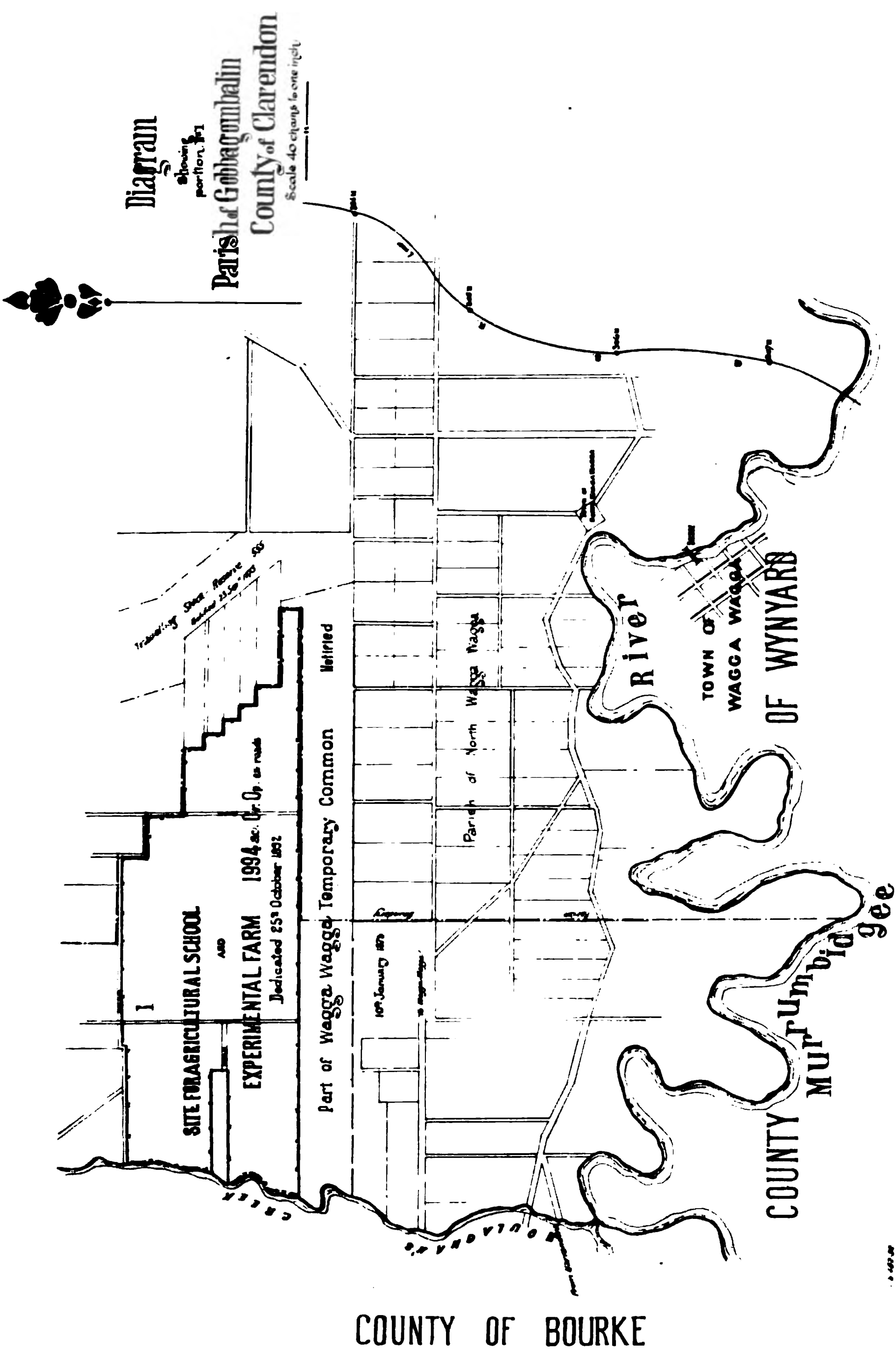
Diagram
showing
portion No. 1
Parish of Gobbagombalin
County of Clarendon
Scale 40 chains to one inch
SITE FOR AGRICULTURAL SCHOOL
AND
EXPERIMENTAL FARM
1994 ac. 0 r. 0 p.
Dedicated 25th October 1892
Part of Wagga Wagga Temporary Common
Notified
Parish of North Wagga Wagga
River
TOWN OF
WAGGA WAGGA
COUNTY OF WYNYARD
Murrumbidgee
CREEK
COUNTY OF BOURKE

"Rhubarb leaves are said to be a cure for crickets. A large bakehouse was some years ago infested with crickets. As the hot weather came on the nuisance became very serious. The baker was advised to lay some rhubarb leaves about the place. The light of the morning revealed nibbled leaves and myriads of dead crickets; and this was the last of them in that bakehouse."

As the practice in allowing poultry to run in the orchard is comparatively common, it is well to mention that they should be carefully excluded when poisonous remedies are being used. On the other hand, should the invasion of insects be slight, poultry, turkeys especially, will be found very effective in keeping them under.

Anthracnose and Sulphate of Iron.

At a meeting of the Central Agricultural Bureau of South Australia on the 24th October last, the Secretary reported that Mr. W. F. Snow had shown a branch of a vine badly attacked by anthracnose. This vine was left untreated, whilst adjacent vines treated with the sulphate of iron solution during September, before the leaves appeared were so far perfectly free from disease.

Murrumbidgee Experimental Farm.

The area decided upon as a suitable site for an agricultural school and experimental farm at Wagga Wagga having been finally dedicated to the Department of Agriculture, we are enabled to give a correct plan showing the position of the farm as regards the town of Wagga Wagga. It will be seen that the area covers 1,994 acres, and that it is bounded along the western border by Houlaghan's Creek. Considerable progress has already been made with the necessary clearing and fencing. Steps are also being taken with a view of planting an orchard with fruits suitable to the district, and a large area will be set aside for the purposes of a vineyard, as in all likelihood a school of viticulture will form an important adjunct to this farm.

National Prizes for Representative District Shows.

In continuance of the policy inaugurated a couple of years ago of providing a series of National Prizes (supplementing the ordinary schedules of the Societies) for competition at certain Agricultural Shows throughout the Colony, the Minister has, subject to the vote of Parliament, approved of the following grants from the funds of 1893:—District No. 1, Lismore, £200; No. 2, Maitland, £350; No. 3, Camden, £350; No. 4, Moruya, £150; No. 5, Inverell, £250; No. 6, Dubbo, £350; No. 7, Goulburn, £300; No. 8, Wagga, £350; No. 9, Coonabarabran, £100; No. 10, Moama, £100. In the cases of Lismore, Camden, Moruya, Inverell, and Goulburn, whose Shows for 1893 are to be held within the first quarter of the year, the Minister has considered it advisable to stipulate that the prizes shall be offered at their Shows in 1894, as insufficient time is now available in which to properly advertise the lists and secure representation commensurate with the importance of the prizes. In other instances, the amounts will be available for competition at the next forthcoming Shows, viz.: Maitland and Dubbo, in April; Wagga, Coonabarabran, and Moama, in September, 1893.

AGRICULTURAL SOCIETIES' SHOWS, 1893.

Society.	Secretary.	Date of Show.
Wollongong A. and H. Association	J. A. Beatson	Feb. 1, 2
Alstonville and Richmond River F. C. and A. and H. Society	P. J. Daley	Feb. 1, 2
Wollongong A. and H. Association	J. A. Beatson	Feb. 1, 2
Gosford Agricultural Show	H. S. Beveridge	Feb. 3, 4
Clunes A. Society	W. Moses	Feb. 8, 9
Broughton Creek (Berry) Agricultural Society	H. J. Colley	Feb. 8, 9, 10
Manning River A. and H. Association	W. Plummer	Feb. 9, 10
Dapto A. and H. Society	F. W. Lane	Feb. 11
Moruya A. and H. Society	J. Kay	Feb. 15, 16
Shoalhaven Agricultural Society, Nowra	R. Leeming	Feb. 15, 16
Ulladulla A. and H. Association	C. A. Cork	Feb. 21, 22
Luddenham Agricultural Society	K. Campbell	Feb. 21, 22
Armidale (New England) A. and P. Society	W. H. Allingham	Feb. 21, 22, 23
Candelo A. H. and D. F. Association	C. H. Brooks	Feb. 22, 23
Tumut P. and A. Association	W. H. Bridle	Feb. 22, 23
Berrigan A. and H. Society	E. J. Gorman	Feb. 23
Kangaroo Valley A. and H. Society	H. Joyce	Feb. 23, 24
Lithgow A. and H. Society	D. M. Asher	Feb. 23, 24
Macleay A. and H. Association	H. R. Gray	Feb. 22, 23, 24
Southern New England P. and A. Association	J. D. Leece	Feb. 28, Mar. 1
Robertson Agricultural Society	R. G. Ferguson	Feb. 28, Mar. 1
Walcha P. and A. Association	W. J. Gibson	March 1, 2
Bega A., P., and H. Society	A. J. Wilson	March 1, 2
Picton A. and H. Society	G. Bradbury	March 1, 2
Port Macquarie Agricultural Society	A. E. Pountney	March 1, 2
Nepean District A., H., and I. Society	R. Benaud	March 2, 3
Walcha P. and A. Association	H. Chapman	March 8, 9
Namoi P. and A. Association, Narrabri	J. Riddle	March 8, 9
Berrima District A., H., and I. Society	J. Yeo	Mar. 9, 10, 11
Murrumbidgee P. and A. Association (Summer Show)	C. H. Croaker	March 8, 9
*Camden Agricultural Society	W. R. Cowper	Mar. 15, 16, 17
Tenterfield P. and A. Association	J. Harker	Mar. 15, 16, 17
Gunning P. and A. Society	Timmis & Sands.	March 21, 22
Blayney P. and A. Association	G. H. Woolley	Mar. 22. 23
*Inverell P. and A. Association	James M'Ilveen	March 22, 23
*Goulburn P. and H. Society	J. J. Roberts	March 23, 24
Royal Agricultural Society, Sydney	F. Webster	March 29 to April 4.
Mudgee Agricultural Society	J. M. Cox	April 19, 20, 21
*Hunter River A. and H. Association	W. C. Quinton	April 26, 27, 28
*Dubbo P., A., and H. Association	G. H. Taylor	April 26, 27
Upper Hunter P. and A. Association, Muswellbrook	P. Healey	May 3, 4
Warialda P. and A. Association	W. B. Geddes	May 3, 4

* These Societies get the National Prizes.

[6 plates and 1 block.]

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Anthistiria membranacea, Lindl.

"Landsborough Grass."

The Grasses of Australia.

(*Continued from Vol. IV, Part I, page* 2.)

BY F. TURNER,
Botanist, Department of Agriculture.

ANTHISTIRIA MEMBRANACEA, *Lindl.* "Landsborough Grass." *Flora Austr., Vol. VII, page* 543.

QUITE glabrous, sometimes forming dense leafy tufts of 6 inches, the branching stems often elongated to 1 foot or 2 feet. Leaves flat, appearing almost articulate on the short prominently striate sheaths. Floral leaves or bracts with coriaceous sheaths and short lanceolate laminæ. Panicles small, dense, almost cyme-like as in *Apluda*, with very numerous small spikes or clusters, each subtended by a scarcely longer bract. Spikelets scarcely two lines long, glabrous, the four involucral ones pedicellate, the fertile one rather longer than the two pedicellate barren ones beside it. Glumes all thin, the outer one acute with several green nerves, the second with one or three nerves, the awn very fine, scarcely more than as long again as the spikelet. Grain enclosed in the hardened outer glumes, but free from them.

An annual species found in the arid interior of all the Australian Colonies except Victoria. It is fairly plentiful in many parts of the continent, and it is mostly found growing on rich soils. It generally grows in small tufts, but in a favourable season the weak stems lengthen out very much and form an entangled mass often over a foot deep. It is essentially a summer-growing species, and generally it makes most of its growth during the hottest part of the season. I have had this grass under experimental cultivation, and raised an excellent crop of herbage in less than three months from seed. It was grown on a black loamy soil, and during a period of very dry weather, it produced a great amount of rich succulent herbage which horses were very fond of. When cut, just as the flower stems first appeared, it made excellent hay. It is worthy of extensive cultivation in the arid interior either for temporary pasture, or to be cut at the proper time, and turned into hay. It is considered to be a most nutritious grass, and towards autumn it often gets so exceedingly dry and brittle that it breaks up into innumerable pieces, but even then stock of all kinds are said to be so exceedingly fond of it, that they lick the broken stems and leaves from the ground.

There would be no difficulty in bringing this species under systematic cultivation for, under ordinary circumstances, it produces an abundance of seed which usually ripens in November, December, and January. If a large quantity of the seed is required, it would be advisable to fence off a small area where the grass grows plentifully, from which as much seed could be gathered, when ripe, as would sow an immense area.

Reference to Plate.—A, compound cluster of spikelets; B, cluster of male or barren spikelets, and the fertile one, opened out to show how they are arranged; C, fertile spikelet, opened out to show the three glumes and awn; D, male spikelet, opened out to show three glumes; E, grain, back and front views, all variously magnified.

A

ANDROPOGON PERTUSUS, *Willd.* "Pitted Blue Grass."

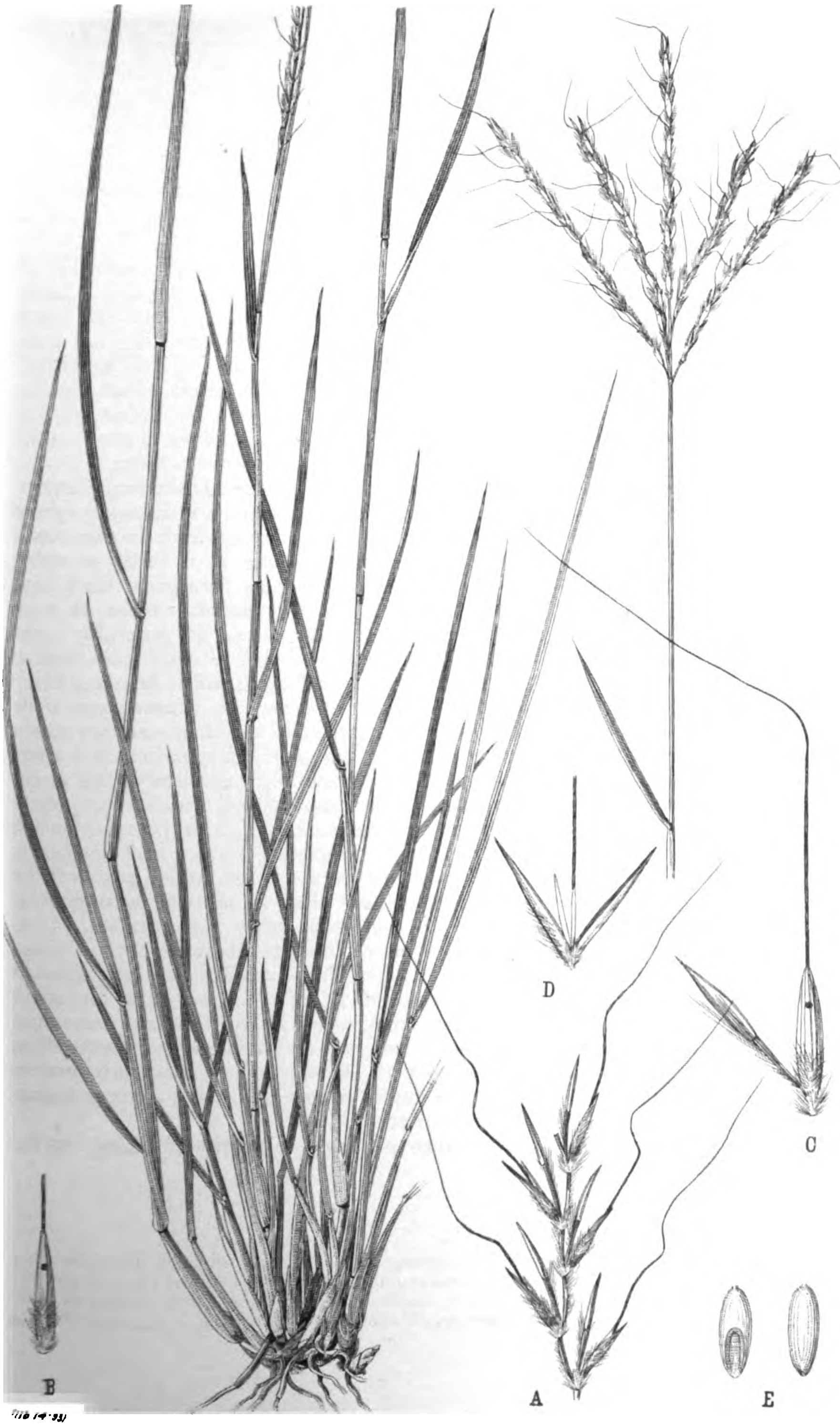
Flora Austr. Vol. VII, page 530.

STEMS slender, 1 foot to 2 feet high, the nodes glabrous. Leaves chiefly at the base of the stem, narrow, glabrous. Spikes, two to five, sessile, or nearly so, at the head of the peduncle, without sheathing bracks, 1 inch to 2 inches long; silky-hairy, as in *A. affinis*, with long hairs on the pedicles and at the base of the sessile spikelets. Spikelets fully two lines long; rather obtuse, the outer glume marked above the middle with a small pit, which assumes inside the appearance of a projecting gland. Awn slender, about $\frac{3}{4}$, rarely 1 inch long. Pedicellate spikelet, usually containing a male flower. Grain enclosed in the glumes of the sessile spikelet, but free from them.

A perennial species, found and recorded from all the Australian Colonies, except Western Australia. According to Mr. Bentham, it is widely spread over tropical Asia. In this country it is found growing both in the coastal districts and in the arid interior, and in many places it is fairly plentiful. It does not appear to affect any particular geological formation, for I have often seen it growing on land overlaying the Wianamatta shales, on stony ridges, on light soils, and also on rather heavy ones. It generally grows taller, however, and produces more herbage on rich alluvial soils than on other formations. The grass is slightly stoloniferous, and it branches freely at the base, but never grows into large tussocks. In consequence of its habit it withstands a great amount of dry weather, and in an ordinary season it will grow more or less all the year round. In sheltered situations and where frosts are not too severe it will make considerable growth during the winter months, which is a great advantage in the pastures of this country, where the greater number of the indigenous species make most of their growth during the summer and autumn months. Some years ago I had this species growing on a lawn, for which I found it a very suitable grass both for summer and winter. After being cut a few times it assumed a dwarf, compact habit, and was easily kept in order with other lawn grasses. I can recommend it as a lawn grass for some of the drier districts in the Colony. As regards the pastoral value of this grass, Baron von Mueller has published the following remarks:—"Mr. Nixon, of Benalla, regards it as one of the best grasses to withstand long droughts, while it will bear any amount of feeding. According to Mr. Bailey's observations it endures cold better than some other *Andropogons* of Queensland. Though not so palatable to pasture animals as some other grasses, this one is important for the summer season, when many others fail in the arid interior."

This grass produces an abundance of seed, which ripens throughout the summer and autumn months.

Reference to Plate.—A, showing the arrangement of the spikelets on the rhachis; B, a sessile spikelet, showing the pit in the outer glume; the awn cut off just above the spikelet; C, a sessile and pedicellate spikelet; D, sessile spikelet, opened out, showing the three glumes and terminal awn, the latter cut off above the spikelet; E, grain, back and front views. All variously magnified.



Andropogon pertusus, Willd.

"Pitted Blue Grass."

Cenchrus Australis, R. Br.

"Tall Burr Grass."

CENCHRUS AUSTRALIS, *R. Br.* "Tall Burr Grass."

Flora Austr., Vol. VII, p. 497.

A STOUT, glabrous grass, attaining 6 to 9 feet. Leaves long and flat; ligula split into cilia. Spike rather dense, 4 to 8 inches long, the rhachis slightly scabrous-pubescent. Involucres very shortly pedicellate, erect, or at length reflexed, broadly ovoid, under four lines long, the inner bristles or lobes, about ten, flattened and very shortly united at the base, plumose in the lower half, scabrous in the upper part, with reversed asperities; one sometimes, but not frequently longer than the others; outer bristles numerous, unequal, subulate, and scabrous from the base. Spikelets (always?), solitary in the involucre and shorter than the inner lobes. Outer glume short, obtuse, hyaline, nerveless; second glume acute, three or five-nerved; third rather longer, five-nerved, with a palea and sometimes a male flower in its axil. Fruiting glume as long. Nut enclosed in the fruiting glume and palea, but free from them.

A perennial species, found principally in the coastal districts of New South Wales and Queensland, and in many places it is fairly plentiful. It is much more common, however, in the northern than in the southern portion of the continent. I have never collected, nor have I seen the species growing, any further south than the Illawarra district. It is generally to be found growing on hill sides and on low scrub lands, and sometimes near water-courses. In some situations it grows into large tussocks, the stems from which may often be seen nearly 9 feet in height. As the herbage of this coarse-growing grass becomes old, it is very rough to the touch, and when in that state cattle will never eat it. If the coarse leaves and stems should be burnt off, however, during October or November, the new growth that is made will be tender and succulent for several weeks afterwards, then cattle will eat it readily enough; but whether there is any nutriment in the herbage I am unable to say. Sheep should never be depastured on land where this grass grows plentifully, more especially when the seeds are nearly ripe, as their coverings (involucres) will fasten on to almost anything, and if they should get entangled in the wool it would be found a most difficult matter to get them out. When the burr grass becomes established on river banks or similar situations it protects them against heavy rains and flood waters. Its tough, fibrous roots form a perfect mat in the earth and bind it so firmly, once the plant becomes established, that it is with difficulty dislodged. It produces an abundance of seed, which ripens during the summer and autumn months.

Reference to Plate.—(A) Showing the arrangement of the spikelets on the rhachis; (B), involucre flattened out; (C), spikelet opened out to show the four glumes and two paleas; (D), nut, back and front views; all variously magnified.

Supposed Poisonous Plant.

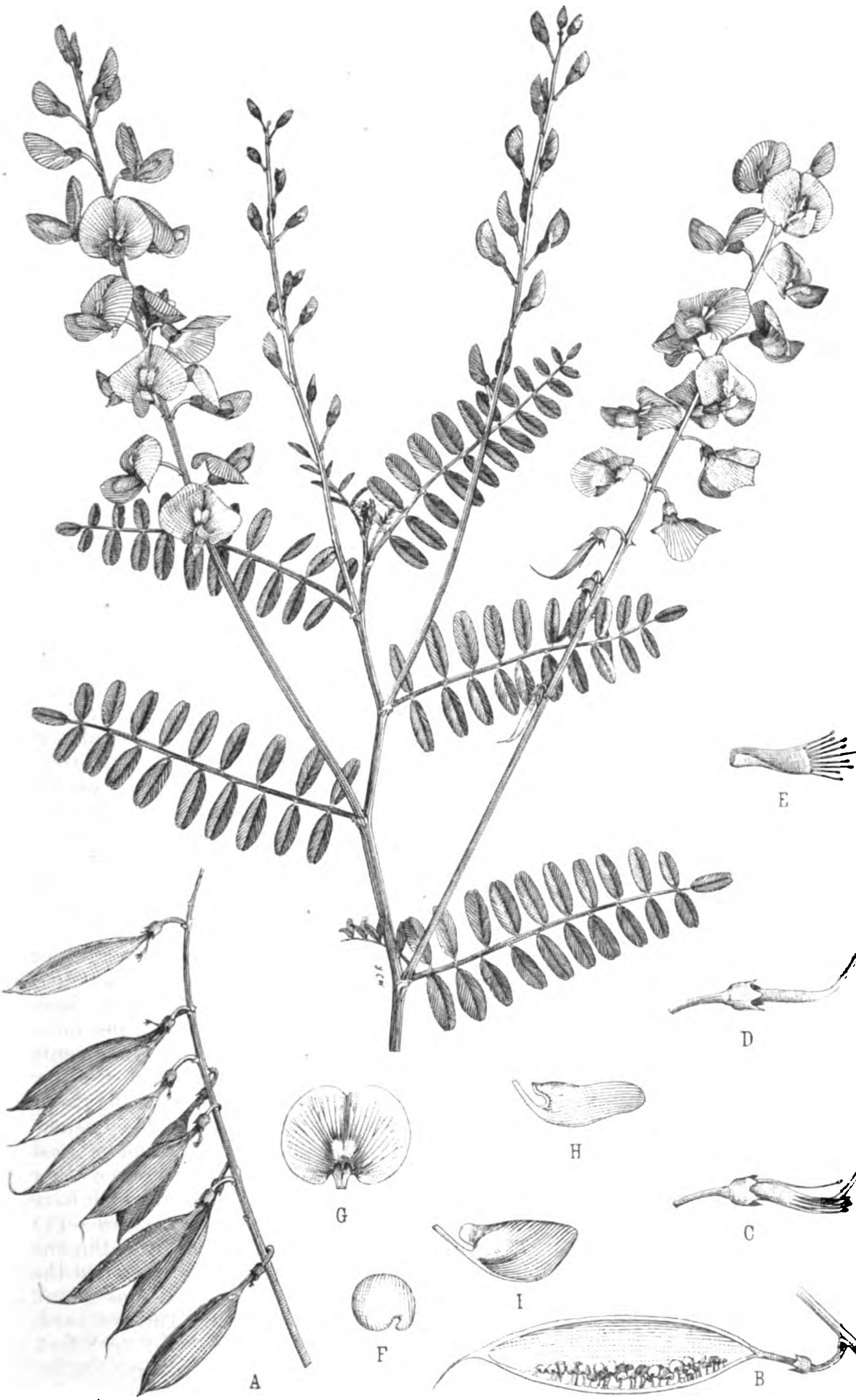
By F. B. GUTHRIE and FRED. TURNER.

A Description and Analysis of the "Darling Pea," "Indigo," "Cranky Pea," &c. (*Swainsona galegifolia*, R. Br.)

Flora Austr., Vol. II, page 217.

A glabrous perennial or under-shrub, with erect flexuose branches, sometimes under 1 foot, sometimes ascending or even climbing to the height of several feet. Leaflets, eleven to twenty-one, or rarely more, oblong, obtuse, or emarginate, mostly four to eight lines long. Stipules small, reflexed. Racemes pedunculate, exceeding the leaves and sometimes twice as long. Flowers rather large, deep red in the original variety. Pedicels rarely longer than the calyx, with minute bracteoles near the top. Calyx glabrous, two and a half to three lines long, the lobes acute, short or nearly as long as the tube. Standard six to eight lines in diameter, with two oblique or almost longitudinal plate-like prominent callosities above the claw; wings shorter; keel broad, obtuse. Style subulate, acute, not inflexed at the end, bearded longitudinally without any terminal tuft. Pod much inflated, membranous, 1 inch to 2 inches long, on stipes varying from two to six lines. The species varies with light purplish-pink flowers, *S. coronillæfolia*, Salisb, and with white flowers, *S. albiflora*, G. Don. The differences in the length of the stipes of the pod do not, as had been supposed, coincide with the differences in the colour of the flower.

This species is, in one form or another, found in many parts of New South Wales from the coast to the arid interior, and in some districts it is very plentiful. During the past two years many specimens have been forwarded to this Department for identification, and in several instances they were accompanied by letters containing most conflicting statements as regards the effect the plant had on animals eating it, a summary of a few of which appears below. It was thought advisable to publish a figure of the plant, with the description and analysis, so that no possible mistake could occur in correctly identifying the right species. It must be understood that the common names given to this plant are also given to three other species growing in different parts of the Colony, specimens of which have occasionally been received for identification. The three species are—(1) *Swainsona greyana*, Lindl. This plant may be distinguished from the one under notice by its more robust habit, large pea-like pink flowers, and the calyx densely covered with white cottony down. This species is found principally in the interior. (2) *Indigofera australis*, Willd. This is a hard-wooded shrub with pinnate leaves. It often attains a height of 6 to 8 feet, and in one form or another is found nearly all over the Colony. It has



Swainsona galegifolia, R. Br.

"Darling Pea," "Indigo," "Cranky Pea."

small pea-like reddish flowers, which are arranged in axillary racemes. These are succeeded by nearly straight pods, about 1½ inches long. (3) *Lotus australis*, Andr., is a dwarf perennial plant, rarely exceeding 2 feet in height. In some districts on the eastern side of the Dividing Range it is very plentiful, but is more sparingly distributed in the interior. Its leaves are composed of five leaflets, three at the end of the stalk, and a lower pair close to the stem. The flowers are sweet-scented, and are arranged in umbels; the colour is usually pink, but they vary from white to purplish. The pods are cylindrical, and about 1½ inches long.

The complete analysis of the Darling pea plant is as follows:—

Water		47·62
Benzine extract—		
Wax	1·05	
Colouring matter	·10	
Ash	·11	
Volatile matter	trace.	
		1·33
Alcohol extract—		
Oily matter	0·55	
Colour and extractives	1·79	
Ash	·21	
		2·55
Water extract—		
Gum	4·47	
Ash	1·22	
		5·69
Acid extract—		
Starch isomers	5·45	
Ash	2·01	
Colours, &c.		
		7·52
Alkaline extract—		
Chiefly albuminoids		16·12
Woody matter—		
Cellulose	8·75	
		18·14
		98·97

Total ash	6·65
Albuminoids	18·83 (from nitrogen).

In a special examination for alkaloids by Stevenson's method, an oily substance of a burning disagreeable taste was obtained on shaking out the acidified extract with ether, in the process of purifying the alkaloid. We were unable to find any conclusive evidence of the presence of an alkaloid in the plant, and if such be present it is there in exceedingly minute quantities. This oil is identical with the oily matter extracted with alcohol, and we endeavoured to prepare the same in larger quantities with a view to testing its physiological action. This proved a difficult matter, as different specimens gave varying quantities of the extract, and even working with 1 lb. of plant it was only possible to obtain a very small yield.

In fact, owing to the length of time involved in the transit, and the difficulty of packing, the bundles of pea, with few exceptions, arrived here in very bad condition, having become heated in the journey, and mildewed in the centre of the bags. The only specimen which yielded the oily substance in fair quantity was a small one brought by Mr. Cruickshank, M.P., and this was the only specimen received in a perfectly fresh condition. We are of opinion that an analysis should be made on the spot, so as to insure a supply of perfectly fresh plants.

A detailed account of the analysis is appended.

One hundred grammes of leaf, flower, and stalk, brought into as fine a division as possible, were taken.

Water.—This varied with the freshness of the sample, some giving 56 per cent. The bundle to which this analysis refers was forwarded to the Department by Captain Menzies, and was not particularly fresh.

Benzine extract.—Purified benzine was used, boiling at 85 degrees Cent. The principal substance dissolved out was a whitish wax, melting at about 70 degrees Cent.

Alcohol extract.—Eighty per cent. alcohol gave a highly coloured extract, containing a small quantity of an oily substance mixed with colouring matters and extractives, and not easy to purify. This oil hardens on exposure to air, and is soluble in ether with some difficulty. No tannin nor organic acids were found in this extract.

Water extract.—Cold water dissolved out a fairly large quantity of a gum, purified by redissolving in water and precipitation by alcohol. In this state it is a gum of a reddish colour. Reduces Fehling's solution on boiling with acids.

Acid extract.—This extract was made with weak hydrochloric acid, which dissolved out substances, which, on treatment with acids, are converted into glucose. They may be classed as starch-isomers. Starch is, however, absent. This extract may also contain some gum not perfectly removed by cold water.

Alkaline extract.—Treatment with caustic potash yielded a very dark-coloured liquid, which gave an abundant precipitate on the addition of acid, and contained probably the greater part of albuminoid matter in the plant. This was not further examined.

Ash.—The greater portion of the ash has been accounted for under the differents extracts. That which still remains unaccounted for is contained in the alkaline extract and the fibre.

Albuminoids.—These were calculated from the nitrogen obtained by Kjeldahl's method.

The only substance which appears likely to possess poisonous properties is the oily substance extracted by alcohol. We are still engaged in obtaining this extract in a larger quantity, with the object of injecting it into a sheep under conditions which will allow of its action being watched. There is, however, considerable difficulty in obtaining a sufficient supply for this purpose the yield being small under the most favourable circumstances, and from specimens in bad condition it is smaller still. Moreover, the pressure of routine work has prevented our giving undivided attention to the investigation. We hope, however, shortly to have sufficient to examine the physiological action of this oil and of the other constituents. The pods and seeds were not submitted to analysis. The plant appears to be poisonous before the pods are formed, and even previous to flowering. Indeed, it is very doubtful whether the hard seeds are digested at all by the animal.

The "Darling pea" or "Indigo" that the following extracts from letters refer to is the *Swainsona galegifolia*. Messrs. Gleeson, in the Myalla district, writing to the Stock Department in 1888, state that 70 per cent. of their young lambs were affected by it, and in this case the plant was not yet in flower. The greater mortality may be due to the fact that at such time the pea is often practically the only herbage, and is especially green and inviting.

Mr. Jas. B. Bettington, Brindley Park, Merriwa, writes as follows:—"I do not regard the Darling pea such a scourge as some do, and I do not think that healthy sheep ever eat it. Salt is an antidote to it, and so long as plenty of salt is supplied in the paddocks sheep either will not eat it, or if

they do will not suffer any ill effects from it. I have killed many sheep suffering from what is popularly called pea eating, and always found them full of worms, but whether the worms are caused by eating the pea or the worms in the sheep cause them to eat the pea I cannot tell."

Captain A. S. Menzies, Reedy Creek, Inverell, writes as follows:—"I have had twenty years' experience of the 'Darling pea,' or 'Indigo,' and am convinced it is nothing else but poison. When stock eat it they will eat nothing else as long as they can get Indigo. They soon fall away, have a wild, distressed look, an awkward, quivering gait, distorted limbs and features, and die at last in an emaciated state. It appears to me a narcotic poison, acting on the nerves and brain. The losses on stock all through these districts are large from this cause, especially among young sheep, and the plant seems to be increasing. It is worse in sheep country than where cattle are run, probably because the latter country is never so heavily stocked. It should be noted that the poison has a marked effect on the fleece of an 'indigo eater.' The wool is nearly always very clean, peculiarly soft, light in condition, and fine in quality. The growth of the wool, as far as length is concerned, does not seem to be at all checked, but the fleece generally is much lighter. The effects generally of the poison pea through these districts are simply disastrous. It is impossible to properly stock the country, and even with all precautions, and with constant care, the losses are at all times very large."

Mr. W. H. Walker, Tenterfield Station, Tenterfield, writes as follows:—"The 'Darling pea' is very troublesome this year; cattle, horses, and sheep are all suffering."

Mr. G. H. Gordon, Gragin, Inverell, writes as follows:—"In the Darling pea there certainly exists, in a most marked degree, constituents injurious to stock, which causes an annual and heavy loss to the pastoralist."

Dr. T. J. Henry, Government Medical Officer, Warialda District, writes as follows:—"*Re* 'pea-eating' cattle, my opportunities for study of the subject have been limited to observing the appearance and gait of the cattle and sheep affected. They fall off markedly in condition and become miserable and drooping, and, even though removed to good grass country, long, and perhaps permanently, if confirmed pea-eaters, remain poor. Their coats lose the glossiness of health and are rough; indeed the rough coat alone will draw one's attention to an affected beast.

"They have a shuffling unsteady gait, and are prone to run into obstacles—'climb trees,' as the bush people laconically term it. I am under the impression that the iris is unusually dilated, though to what extent and for what period it is difficult to determine, and this causes loss of the power of accommodating the vision to a nicety for light and for distance to some extent. This accounts, I am of opinion, for the running into objects. The cerebellum is probably affected also more or less by the pea, and this disturbs the co-ordinating and equilibration medianisms rendering the gait awkward and staggery in bad cases."

The Rev. Dr. Wm. Woolls, F.L.S., &c., whose attention has been called to this plant for a number of years past, has kindly furnished us with the following information:—"*Swainsona greyana*, Lindl. (the poisòn pea of the Darling). This plant was found in Victoria by Mitchell and Grey, and was named *greyana* in honor of the latter (Lindl. Bot. Reg., 1846), but its poisonous properties were first recorded by Baron von Mueller in the 'Transactions of the Royal Society of Victoria,' and subsequently in the 'Documents relating to the Intercolonial Exhibition (1866–67),' in which he states that, although such extraordinary effects were attributed to it on

the Darling, yet cultivated plants were innocuous when given to sheep in large quantities. Mrs. E. Forde, whose late husband was engaged in surveying the Lower Darling in 1865–66, sent me specimens of *S. greyana* at that time, accompanied with some notes respecting the effects it produced on horses. The poison, it was supposed, acted on the brain of the animals, as those under its influence obstinately refused to pass over even a small twig lying in their way (supposing probably that it was larger than it really was), whilst in other instances they attempted to climb trees. Mrs. Forde further remarked that, so bad was the reputation of the plant amongst the squatters on the Lower Darling, it was regarded with horror by them. This species extends to Queensland, where, in common with others of the same genus, it is supposed to be poisonous, but it is not so common in that Colony as in Victoria and New South Wales. As the accounts respecting the poison pea of the Darling vary considerably, it seems probable that the effects of the plant is very much modified by the season. In dry seasons, for instance (such as that of 1865, when the grasses and tender plants failed, and the animals fed abundantly on *Swainsona*), more mischief appears to have arisen than in favourable years, when forage plants spring up in profusion, and afford a varied nutriment for sheep and cattle.

"*S. galegifolia*, R. Br., and *S. coronillæfolia*, Salisb., which in the 'Flora Australiensis' are regarded as varieties of one species, are more widely distributed than the preceding, and have been known from the early part of the century. These, next to *S. greyana*, are the principal forms to which deleterious properties have been attributed, and so impressed have some squatters been with the fact, that they have incurred considerable expense in getting their runs cleared of what they considered poisonous. It is highly probable that in some parts of the Colony, these species are not distinguished from the native indigo (*Indigofera australis*), and hence they are freely spoken of as 'indigo.' From statements made by persons in different parts of New South Wales, there can be no doubt that these plants, in certain seasons and under certain conditions, are highly injurious to sheep and cattle, but I have been assured by a gentleman in the neighbourhood of Mudgee, who had had great experience in such matters, that he did not consider *Swainsona* poisonous when eaten with other kinds of herbage. It seems also probable that the bad qualities of this genus, as indeed of other leguminous plants are more fully developed when they come to maturity. *Swainsona* and other injurious plants exercise a greater influence on animals in lands recently occupied and yet in their natural state, than when they have been opened up for cultivation or pasture. This, however, may arise from the gradual destruction of noxious species, or from the fact that animals learn to distinguish in some degree between what is suitable for them and what is not. The great danger seems to be in seasons of drought, when they cannot procure wholesome forage and will eat anything that comes in their way. It is likely that *Swainsona* in a young state has a similar effect to *Medicago denticulata* in the early spring, when cattle get swollen from eating too much of it and die unless relieved. I have seen some in that state on the banks of the Cudgegong."

Bailey and Gordon, "Plants Reputed Poisonous and Injurious to Stock, Queensland," say:—"Although the 'Indigo' plant does not contain an irritant poison, it has undoubtedly occasioned great losses in stock. Its effect on sheep is well known to stock-owners; they single out from the flock and wander about listlessly, and are known to shepherds as 'indigo eaters.' When once a sheep takes to eating this plant it seldom or never fattens, and may be said to be lost to its owner.

"The late Mr. Charles Thorn made, in 1873, an experiment with this plant which is deserving of a place here, as showing its effect on sheep. A lamb that had become an 'indigo eater' was placed in a small paddock near the homestead, where it refused to eat grass. Mr. Thorn collected a quantity of the indigo plant and this it ate greedily, following all over the paddock and eating it out of his hand.

"The Hon. G. King, M.L.C., kindly supplied a bag of the plant to the Chief Inspector of Stock for analysis. Mr. K. T. Staiger experimented on several animals, with the result of showing that it was possessed of very powerful sudorific properties, its effect on frogs, for instance, being to reduce them in a few hours to mere skeletons. Further experiments pointed to the probability of its being a most active poison when administered in a volatile state.

"Of the Darling pea, Mr. Wm. Nepean Hutchison says that stock readily devour it, and it takes little to drive them perfectly silly. On one occasion a mob of travelling sheep camped no distance from the town of Taroom. Quantities of the pea were growing about where the horses were hobbled for the night. The following morning it was noticed how strange the animals appeared. They had been on the road some nine weeks, and were up to this date caught without any trouble, but on this particular occasion it took several of the men to do so. Their eyes were staring out of their heads, and they were prancing against trees and stumps. The second day two out of the nine died, and five others had to be left at the camp. When driven they would suddenly stop, turn round and round, and keep throwing up their heads as if they had been hit under the jaw; they would then fall, lie down for a while, and would go through the same agonising performance when they once more attempted to stand. On one station in the course of a few weeks eight head were shot, having injured themselves past all hope of recovery.

"The specimens which have usually been forwarded to us as the 'indigo' have been one or other form of *Swainsona galegifolia*."

Reference to Plate.—A, raceme of seed pods; B, seed pod with one of the valves removed to show the arrangement of the seeds; C, stamens and pistil; D, pistil; E, sheath of stamens, the upper portion flattened out; F, seed; G, upper petal or standard; H, wing or lateral petal, side view; I, lower petals or keel, side view, C, D, E, F, H, and I magnified.

Plants Visited by Bees.

In reply to the series of questions asked by this Department, relating to the plants most visited by bees, a large number of reports were furnished from the several districts of the Colony from which the following has been compiled.

Reports were received from thirty-eight apiarists in the county Cumberland, Messrs. Archibald, Aubin, Ayling, Bailey, Bolus, Bennett, Braithwait, Brown, Cadden, Daley, Davidson, Edmonds, Gambling, Gray, Gardner, Hodgkins, Hinsch, Hensley, Hambley, Hill, Hall, Henderson, James, Littlejohn, M'Hale, M'Lean, M'Farlane, Porter, Prosser, Pemberton, Riddel, Rigg, Sadler, Stokes, Turner, J. L. Thompson, Woolrych, and Wilcour from whose reports the following is collated.

As might be expected in the county Cumberland, where the population is more dense, and the ornamental flowering plants more extensively cultivated, a greater number of plants are open to selection by the bees, and in the various replies such answers as "all the summer fruit-trees," "garden flowers" occur. As in other parts of the Colony, native trees, such as the Eucalypts, are by far the most remarkable as yielding honey; the ironbark, grey gum, bloodwood, blue and white gums, with the blackbutt and woollybutt being named by the observers, with different varieties of ti-trees, acacias, banksia, grass-tree, boronia, waratah, and "all the bush flowers."

As above pointed out, cultivated plants claim an amount of attention, the orange, lemon, apple, pear, peach, apricot, and grape vine being mentioned by several, whilst among vegetables the cucurbitaceous plants, as melons, pumpkins, cucumber, vegetable marrow, and squash, together with the pulses, (peas, beans, scarlet-runners, and French beans) are the best. In plants cultivated for ornamental purposes, the mignonette, sunflower, clematis, tuberose, evening primrose, verbena, candytuft, wallflower, and aster are those most frequently recorded, but bees have also been noticed on dandelion, thyme, sage, horehound, rosemary, maize, buck-wheat, also on spear-grass, kangaroo, and couch-grass.

In this, the Metropolitan county of the Colony, the above-named plants are in bloom in the seasons of the year as follows, and, regarding their value as honey-producing plants, at different times, the observers give information from which the following notes are made. The various fruit blossoms are recorded by the greatest number as flowering in the spring, ten of the gentlemen mentioning them in general terms, while six others named the orange, three the lemon and apple, and the peach, pear, plum, apricot, and grape vine are each mentioned by one; other spring blooming plants noted are the wattle by nine, Eucalypts and clover by six, ti-tree and thyme by six, and dandelion, thistle, pumpkins, red honeysuckle, mignonette, waratah, giant lily, willows, turpentine, and stringybark, with the small wild flowers by others. In the summer the Eucalypts stand at the head of the list,

being recorded by eight observers, and the sunflower is noted by seven; the garden flowers being now in full bloom are more or less noted by all the reporters. The citrus fruits, mignonette, pumpkins, maize, honeysuckle, thyme, clover, buttercup, dandelion, passion fruit, melon, and cucumber being all noted. To these are added in the autumn, rosemary, myrtle, Lima bean, loquat, blackthorn and box; mignonette and passion fruit appear after the Eucalypts to be the best plant in this season. During the winter season, preference seems to be given to the wild flowers and weeds, but the banana, apple-tree, and mignonette are given also, and one observer mentions that the wattle is frequented at "end of winter for pollen."

North Coast.

Following the coast line northwards, Messrs. Harden, Patten, and Pender replied from the Hunter; Mr. Buttsworth from Stewart's River; Messrs. Dick and Trotter from Port Macquarie; Messrs. Anderson, Davies, Folbigg, Green, March, Morissey, and Nelson from the Clarence River; and from the Richmond River, Messrs. Bagot, Bianden, Carlill, Daly, Fisher, Gaggin, Horan, Hutchinson, Martin, Morris, M'Donald, Perry, Rankin, Selwood, and Steinmark.

The character of the vegetation becoming more tropical, a vast amount of trees and shrubs are found to be visited by the insects in their quest for both honey and pollen; and added to the indigenous vegetation is the great number of cultivated fruit-trees and crops. The genus Eucalyptus is very melliferous, notably, blood-wood, ironbark, grey, blue, and red gums, and the stringybark, while the ti-tree is also considered a good honey-yielding plant, ten different observers from the Richmond and nine from the Clarence noting it. Other trees mentioned are the acacia, silky-oak, bean-tree, mangrove, peppermint, and wild apple. Of the smaller shrubs, the native raspberry, honeysuckle, and the various indigenous heath plants, with the lantana, appear to be most frequented.

The introduced fruit-trees have great attraction for the insects, the orange, lemon, peach, and quince being the most favoured, but melons, pumkins and gramma, the banana, and guava have all been noted. The flowers of maize are very attractive, an account of the great amount of pollen they contain.

Eighteen observers from the Richmond and Clarence districts note clover, while the sunflower, buck-wheat, grass-tree, mignonette, passion-fruit flowers, and bell-flower are all mentioned, as well as various species of grass, notably couch, rib, and wire grass.

In the reports from the Hasting and Manning the turpentine, bloodwood, and ironbark, the broad and narrow-leaved ti-tree are the best of the timber-trees for bearing honey-yielding flowers, and maize, clover, mignonette, and mustard are much sought after. Reporters from all parts of the northern coastal districts mention the good qualities of the fruit-trees, the blossoms of which afford honey of the finest quality and flavour. Prominent among these are the orange, lemon, apple, and quince, the peach and apricot, nectarine and loquat.

From the North Coast clover is recorded by thirteen observers as flowering at springtime, the other plants of the season mentioned being the gum-trees and wattles. At this time they note maize, the orange, and lemon, ti-tree and mangrove, peach, and apricot, bananas, buckwheat, lucerne, sunflower, all the native heath plants, and one observer adds the cut stumps of sugar-cane. In the summer the native trees (Eucalypts, ti-tree, Christmas bush), and the numerous garden flowers are available. Bloodwood appears to be

the favourite, while melons, pumpkins, maize, rape, and hemp, sunflowers, bananas, buckwheat, and citrus fruit-trees are also noted. Mahogany, which is stated to "bloom every other year," is given as a valuable honey-producing tree at this season. The ti-tree, maize, and pumpkins are noted by the greatest number of observers as being visited in autumn, other plants mentioned for this portion of the year being the thistle, banana, lucerne, lantana, hemp, and lemon. Regarding the ti-tree, it is stated by an observer at Broadwater, Richmond River, "to be the largest honey-yielder we have."

In winter time the plants in bloom would seem to be limited in these parts of the Colony, an observer, writing from Casino, Richmond River, stating that "our best honey plants, as a rule, do not bloom in winter." The following are, however, mentioned :—"Coral-tree, wild raspberry, lantana, and Scotch thistle (which blooms on the Clarence all through the winter), bananas, clover, and also a few eucalypti and scrub flowers."

North Table-land.

The Northern Table-land being well adapted for agriculture, the reports from that district of the Colony have an especial interest. Reports in answer to the questions were forwarded by Miss Mack, Pallal Station, and by Messrs. Chamberlain, Crawford, Croker, Deverell, Dunbar, Engil, Hayne, Hooke, Hopson, Lock, Merry, Pemberton, Pennington, Richardson, Rowsell, Teys, Wales, Waller, Webb, and Whitten.

The replies given by these observers, in the main, bear testimony to the value of the indigenous flora as honey plants. All refer to the Eucalypts and wattles as being, when in flower, much visited by the bees. In the vicinity of the towns, Armidale, Tenterfield, Inverell, and Glen Innes, the cultivated plants and fruit-trees are mentioned. Sunflowers, white clover, mignonette, forget-me-not, and lucerne, being the most generally noted ; at Tamworth, these are all given, as well as several flowering trees and shrubs, such as bignonia, honeysuckle, holly, the grape vine, Bougainvillea, horehound, and the white poppy ; and at Armidale the Scotch thistle is added to the list.

Further north at Glen Innes and Tenterfield, the same plants hold place, together with pumpkins, scarlet-runners, the cherry, and the blackberry. From all places, whence reports were returned, maize is specially noted as valuable for pollen, while sunflowers, mignonette, clover, and the pumpkin would appear to be the best of the cultivated plants, excepting the roseaceous and citrus fruit-trees.

In this district the spring and summer are the best for honey plants, the fruit-trees and wattles in spring with the Eucalypts and garden plants in summer forming the chief attractions. The fruit-trees noted are peach, apricot, apple, pear, and cherry. those with clover, sunflower, blackberry, mignonette, Scotch thistle, sorrel, and mustard ; of native trees mentioned along with the wattles are the native apple, yellow jacket, blackbutt, white and grey gum. In summer, maize, scarlet-runner, pumpkins, lucerne, horehound, and white clover are given, while the Eucalypts and native apple are the chief indigenous plants whose flowers are noted for honey. These trees are also mentioned for the fall of the year, while maize and Japanese buckwheat are the only two added to the list. In the winter, the orange and lemon, clover, lucerne, mignonette, and the wallflower are visited by the bees, and when in bloom the yellow-box and red-gum. The native apple is also recorded for this season of the year.

Western Districts.

From the Western districts, embracing Bathurst, Parkes, Orange, and the counties west of the Blue Mountains, reports were received from Messrs. Beggs, Berney, Bowen, Brennan, Brown, Chapman, Davis, Dennett, Ezzy, Fielding, Gardiner, Garner, Grunsell, Halsted, Hanson, Hawke, Hyland, Kirkpatrick, Lumsden, Marsh, Mathias, M'Kenny, Newman, Niven, Poilie, Richardson, Shakespear, Shaw, Sheathfield, Sykes, Taylor, Waldron, Walsh, Westcott, Willott, Wilson, and Wright. As is natural, from such an extensive fruit-growing district, as that represented by the reporters named, the summer fruit-trees occupy an important position, and are the most generally noted to be frequented by bees. The various trees, coming under that category are all given by correspondents from the different centres in the district under review. Conspicuous amongst these are the apple, pear, quince, plum, cherry, peach, apricot, with the gooseberry and strawberry. The forest growth is, however, not neglected by the bees, the white, red, and grey gums being the most frequently noted.

From Bathurst, the reporters mention white clover, lucerne, thistles, grasses, and buckwheat, while herbs, such as sage, pennyroyal, thyme, and lavender, with the sunflower, mignonette, and wallflower, are noted, and the reports from Orange and Molong give also the poplar, hawthorn, willow, blackberry, hollyhock, dandelion, and horehound as well as the beforementioned plants.

A great number of plants bloom in spring in this district of the Colony, the replies to the question covering the majority of the cultivated plants of the district. The fruit-trees are now in flower, and with the Eucalypts, wattles, and clovers, yield an abundant supply of honey. The other plants most in favour are: dandelion, lucerne, mignonette, thyme, buckwheat, horehound (stated to be 'superior to all others'), and the buttercup. The poplar and willow are also recorded as honey producers. The sunflower, maize, white clover, pumpkin, and melon are the principal cultivated plants noted as yielding honey, but the Eucalypts seem to be more productive. Other indigenous plants given are the native apple and Darling pea; these, with the golden rod, white lily, marshmallow, dandelion, borage, and mignonette complete the list. In autumn Eucalypts are the best plants for bees, and are given by no less than nine of the reporters as yielding honey in this season. The white box and native apple are likewise mentioned; other plants noted are the sunflower, lucerne, maize, centuary, evening primrose, and plantain. The want of winter flowering plants is in this district severely felt. A reporter from Blayney says, that the bees require to be fed during winter, unless they have collected a good store of honey; the chief plants noted for the season are bottle bush, grass-tree, white box, garden honeysuckle, and a species of eucalyptus. It may be noted that one observer in this district (Bathurst) mentions furze as being a good plant for the bees, and adds that it is "in blossom all the year round," and another gives the spider plant (*Cleome pungens*) as being the "greatest honey-producing plant that we have."

South Table-land.

From the southern districts replies were forwarded by Messrs. Armstrong, Berrisford, Brett, Brockman, Brown, Clegg, Dewe, Douglas, Faulkner, Ferguson, Frauenfelder, Grosse, Jones, Kendall, Halloran, Hanckel, Hensley, Lesmond, Manns, Marks, Maxwell, Macansh, MacDonough, McGillivray, McGrath, Niblock, Pacey, Paterson, Peers, Plim, Plummer,

Smith, Stafford, Timms, Wallace, Warby and Wood. Here, as elsewhere, the indigenous trees and shrubs would seem to possess great attraction for the bees. About Albury, the white, red, and yellow box, with the stringy-bark, red-gum, and native apple are the most frequently noted. The familiar garden flowers and herbs are, however, recorded as being favourite objects of attention, the sunflower, mignonette, violets, and melons, with the potherbs, such as mint, sage, thyme, rosemary, and borage being noticed. The various fruit-trees and some of the common field plants, grasses, and dandelion are named by the reporters. In the more northerly parts of the district maize, poppies, and thistles are noted about Junee and Wagga Wagga, while in the Adelong and Queanbeyan districts the lilac, jasmine, yucca, and lavender are added to the list of mellifluous plants, and the old English favourites, the hawthorn and wallflower, are given from the neighbourhood of Cooma. Observers residing at Deniliquin and Moama note practically the same plants, particularising the gum-trees, with the fruit-trees and garden plants as well, and give the names of the pear, quince, cherry, peach, orange and lemon, as well as cucumbers, turnips, and the chrysanthemum.

The replies given by observers in this district regarding the plants of the different seasons are very exhaustive. Prominent amongst those noted are the wattle, red-gum, and clover, these being mentioned, the first by thirteen and the other two, by ten reporters. The fruit-trees and dandelion come next for spring blooming plants, while the common plants of the kitchen garden are nearly all enumerated, as well as several of the favourite flowering plants, such as the wallflower, mignonette, clematis, and poppy. The majority of these trees and plants continue in bloom during the summer, while pumpkins, melons, sunflowers, honeysuckle, and oxalis, increase the range of plants open to selection. The native trees in bloom at this season are chiefly the yellow box, pepper tree, red gum, stringy-bark, native apple, ironbark, blue-gum; the Christmas bell and lantana are also now in bloom. The autumn in this district of the Colony is not so prolific of flowering plants as the warmer parts, but the Eucalypts are still the best from an apiarist's point of view, but the chrysanthemum, maize, sorghum, couch, and summer grass, pumpkin, cucumber, and sunflower are also noted. The winter in this district is noted by several reporters as having no flowering plants, but others mention white and yellow box, grey and white gum, "sometimes" rosemary, sage, thyme, violets, dandelion, and honeysuckle.

South Coast.

The large dairying districts along the Southern Coast from Eden northwards to Sydney offer great facilities for apiculture, and the reports of beekeepers from that district are, therefore, of interest. The following gave the result of their observations on the plants visited in their several localities:—Messrs. Beckitt, Bielieter, Colhoun, Crawford, Cutcher, Geldmacher, Gordon, Hungerford, Jenner, Kelly, Millington, Neville, Phillips, Somerville, and Whiteley. Judging from their reports the indigenous plants are most valuable for the purposes indicated; the majority of the observers named giving "native wild flowers" and the various species of Eucalyptus as great favourites, and some mention the wattles and native apple. About Kiama and Wollongong pumpkins, maize, sunflower, buckwheat, and the strawberry are noticed; and the same favour is extended to these plants about Nowra.

Amongst the forest-trees mentioned are the ironbark, stringybark, the blue, white, gray, and spotted gums, the bloodwood and the blackbutt. The best of the cultivated plants are maize, clover, thyme, wallflowers and sunflowers, while thistles, dandelion, and sorrel are noted. A little further south, as the climate becomes more temperate, in the vicinity of Bombala, Bega, and Eden, the gooseberry, raspberry, strawberry; the fruit-trees—apple, pear, peach, and quince, together with such widely different plants as broad beans, pumpkins, cabbage, maize, sunflower, poppy, dandelion, and mignonette are noted. Here again, as elsewhere, the forest trees, Eucalypts, acacias, and native apple, as also the grass tree, native honeysuckle, the numerous wild heaths and bush flowers are reported to be, when in flower, covered with insects searching for honey or pollen, as the case may be.

The seasons at which the various plants, noted above, bloom in this district, is also of interest, particularly the winters being cold, it is desirable that persons who have bees should know what plants to cultivate or encourage during the other seasons, in order that their stocks may survive the winter, and require as little artificial feeding as possible. The indigenous spring blooming plants noted are, first, the wattle, then the ironbark, dog-tree, and mountain ash; clover is now in bloom, as well as mignonette, the sunflower, poppy, and strawberry; these, with the fruit-trees are all resorted to by the bees. As the season advances the Eucalypts come into bloom, the blackbutt, stringybark, woolly butt, bloodwood, and gray-gum being separately mentioned. Maize, clover, and hops are now available, and wild flowers are plentiful, while of garden plants those mentioned are the sunflower and mignonette. Heath flowers in the autumn with some of the Eucalypts (which have remained in flower) are the only honey plants mentioned, excepting the general favourite, mignonette, the vine, and thistles. A few gum-trees flower in the winter months. One observer mentions the spotted gum, but wallflowers, honeysuckle, and ivy are the only other plants noted.

Conclusions.

Reviewing the foregoing condensed notes, it is worthy of remark that the flora of Australia possesses honey-producing trees, shrubs and plants of a high standard of excellence. The honey produced by bees in the near neighbourhood of the forest being of the finest quality, and having few (if any) faults. Judging from the replies to the other questions asked, the bee, while a gum-tree is in bloom, will pass over the most tempting plant in a garden and wing its way to the borders of the bush; but, on the other hand, a field of maize in tassel is a source of the greatest pleasure to the busy little workers, who swarm in countless numbers, collecting the pollen so necessary for their wants. The plants which next seem to have the greatest attraction are the fruit-trees, familiarly called summer fruits. These are mainly of the natural order, *Roseaceæ*, the flowers borne by these being of a white or pinkish colour, are very sweet-smelling, and possess a quantity of good honey, eagerly collected by the bees; the citrus family of fruits also are favourite hunting grounds, as from all parts of the Colony the orange and lemon are noted. The sweet perfume of these trees is proverbial, and the honey collected by bees in the neighbourhood of an orange orchard is of the finest quality. Clover (both white and red) yields a large quantity of first rate honey, and bees kept at places where clover grows never fail to visit the modest flowers of the plant; dandelion, also, is a valuable honey-yielding flower, and is noted in all districts from Albury to Tenterfield.

Regarding the size and colour of the flowers most affected by the bees, much diversity of opinion exists amongst apiarists, and in the face of the

very conflicting replies, it would be vain to determine what coloured flowers are most attractive. It is indeed an open question if colour has any effect in the matter, but, as a general rule, it may be taken that white or light pink, yellow and pale blue seem to be the favourite colours of bee-plant flowers; and, again, while the majority of observers give it as their opinion that small flowers are preferred, it must be remembered that the flowers of melons, pumpkins, and sunflowers are anything but small. No rule, however, can with certainty be laid down, the insects apparently seek for honey wherever it is to be found, quite regardless of size; as one observer tritely says, "The bee is quite indifferent to the size of a flower, provided it gets what its wants."

In conclusion, it may be of interest to give two instances—one, of the—it may be called—eccentric tastes of the bee, and the other as illustrating how an experiment intended for one purpose may lead to the development of another and different use. Mr. A. J. Perry, of Ballina, mentions in his report that in the month of February he "noticed at a saw-mill, where they were cutting some teak, that the bees came in large numbers to the saw-dust every day for about two weeks, even while it was exposed to the sun"; and adds that he was quite unable to account for the fact; and Mr. G. E. Hooke, of Tamworth, writes that "one year I grew a plot of white poppy for experiments with opium, and found the flowers literally crowded from daylight to dark with bees."

Medicinal Plants.

By. T. PHILLIPS-GIBSON,
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JALAP (*Exogonium Purga*, Bentham).

JALAP is a native of the eastern slopes of the Mexican Andes, in which situation it is exposed to the sea breezes from the Gulf of Mexico. It grows naturally at an elevation of from 5,000 to 8,000 feet above the sea level. It is particularly abundant about Chiconquiaco and the neighbouring valleys, and also around San Salvador and the eastern slope of the Cofre de Perote. The principal market for the drug is Xalapa or Jalapa (from whence it derives its common name), and is exported mainly from Vera Cruz, a seaport some few miles from that town. The climate of these tropical localities is very humid—in fact, rain falls almost every day, and the temperature varies from 60 degrees to 75 degrees F. It will thus be seen that it is a plant suited for cultivation on the mountain ranges of the north coast of this Colony, where in the partly cleared forests, with a deep rich soil and shady situation, it would succeed to perfection. The *Chemist and Druggist* (London) of 20th April, 1888, in a notice of Baron F. von Mueller's "Select Extra-Tropical Plants," says: "Jalap might be grown successfully in Australia," and the implied doubt as to the profit of the crop is met by the fact that when once started it would require little or no attention, but the plants might be left to ramble naturally about the stems of the shrubs and trees at will; and, further, Humboldt, in "New Spain," vol. iii, page 36, states that the true jalap, "*Purga de Xalapa*, delights only in a temperate climate, or rather an almost cold one, in shaded valleys and on the slopes of mountains."

Although a native of the tropics, jalap has been grown as far north as New York, and grows freely in a sheltered border in the south of England and the Channel Islands, but its flowers are there produced so late in the autumn that they rarely expand and the roots are liable to be killed by the frosts, but in the parts of this Colony indicated there would be little danger of this occurring. It has been introduced into India, and grown with success on the Neilgherry Hills, and has been said at Ootacamund to "grow as freely as a yam," producing tubers of a very large size.

The jalap plant belongs to the same Natural Order as the convolvulus, sweet potato, and ipomœa, and has at different times been called *Convolvulus purga* and *Ipomœa purga*. The flowers, however, mark it as a distinct species from either, being salver-shaped, and Bentham's name (as above) fully meets its characteristics, the word "exogonium" meaning that the stamens project out of corolla.

The use of the tuber of a convolvulaceous plant, as a purgative medicine in Mexico, was made known to European doctors by the early Spanish voyagers. The new drug at once came into favour, and so highly was it esteemed that during the sixteenth century large quantities were imported.

Monardes, in 1568, says that it was called ***Ruybarbo de las Indias*** or ***Ruybarbo de Mechoacan***, the first meaning Indian rhubarb, and the latter in allusion to the province of Mechoacan, from which place the supplies were derived. Some writers have said that this drug mentioned by Monardes was the jalap of modern commerce, but this can hardly be correct, as the description of the drug, and the place from which it is stated to have come, do not agree with the true jalap, and the trade terms in use distinguished between the two, the Mechoacan drug being known as "white jalap" and the officinal kind, from its darker colour, "black jalap." The two kinds, indeed, were often confounded one with the other, but were perfectly separated in 1619, by Colin, a physician of Lyons, who mentions jalap "*racine de jalap*," as then a new drug in French practice, and but lately introduced. The source of jalap was not clearly ascertained until about the year 1829, when Dr. Coxe, of Philadelphia, published a description and a coloured plate from a plant sent to him from Mexico two years before. (*American Journal of Medical Science*, 1829–1830.)

The part of the plant which is employed in medicine is the root, or, correctly speaking, the tubers. A root of jalap throws out several underground shoots, which have other roots at intervals. These, while but an inch or so long, become thickened or carrot-shaped, gradually growing larger, sending out a few rootlets from their surface, and tapering off below. For propagating, each of these rootlets will form a new plant, and as they are very abundant, no difficulty can be experienced in increasing the plantation when once a stock has been established. The fresh root is extremely rough, on the outside of a dark brown colour, but is white and fleshy internally.

Except in Botanic Gardens and in India, where, in 1888, at Dodabetta, between 5,000 or 6,000 tubers and several thousand cuttings were planted, and in the Neilgherry Hills, no proper efforts have been made to cultivate jalap on a commercial basis, though Schiede, writing in 1829, says that the Indians of Chiconquiaco were then commencing to grow it in their gardens. The trade is therefore dependent on the supply of the wild plants collected by the natives of Mexico, who are said to dig up the roots during the whole year. It would appear that this is not a very sensible mode of collection, as it is evident that the best time for gathering them would be when the plants have died down and the roots are at rest, which is a further argument why the proper culture of the plant and a rational mode of collection would result in making the venture profitable. The smaller roots are dried whole, and the larger ones are cut transversely, or are simply gashed with a knife, so that they may dry more readily. As sun-drying would be very slow on the shaded slopes of Andes, if not impossible, the roots are hung up in nets from the roof of the Indian's hut, where they gradually dry, but at the same time often acquire a smoky smell. According to the reports of the drug sales of the last few years the roots now appear to be cut much smaller, probably in order to dry them more quickly.

The jalap of commerce is in irregular sized pieces, mainly depending on the size of the original roots. The pieces are usually pointed at the lower end, deeply wrinkled and furrowed, of a dark brown colour. The larger roots are cut lengthwise or in halves and quarters, but the smaller ones are usually entire. Some are spindle-shaped like a radish, others are nearly globular. These, however, are seldom solid. Good jalap is described as "ponderous, tough, hard, and often horny, becoming brittle when long kept, and breaking with a resinous, non-fibrous fracture. Internally, it is of a pale dingy brown or dirty white. It has a faint smoky, or rather coffee-like odour, and a mawkish taste, followed by acridity."

Jalap owes its value as a medicine to a resin contained in the tubers, and called *Jalapin*. This is obtained by digesting the powdered root in rectified spirit, and concentrating the extract to a small bulk, after which it is poured into water. The resin is thus precipitated and afterwards washed and dried.

The British Pharmacopœia recognises four distinct preparations, namely, the resin above mentioned, a tincture, an extract, and the powdered root. It is also an ingredient when mixed with scammony of another officinal powder. In the preparation of the extract the jalap is macerated for seven days in rectified spirit, the tincture pressed out and filtered, after which the spirit is distilled off, leaving a soft extract; to remove any extract that may remain the jalap is again macerated, but in water, for four hours, and strained through flannel; this is evaporated, and the resulting extract mixed with that previously obtained by the agency of the spirit, and the whole evaporated at a temperature not exceeding 140 degrees F. until it becomes thick enough to form pills. The dose of this extract is from 5 to 15 grains. Powdered jalap is composed of five parts of the ground root, nine parts of acid tartarate of potash (cream of tartar), and one part of ground ginger, well mixed, and passed through a sieve; dose from 20 to 60 grains. The tincture is more difficult to prepare, and as it requires considerable attention during the process, it is not advisable to attempt the operation without proper appliances, and time to attend to it.

Jalap in any of its forms is a powerful and useful purgative, but occasionally causes nausea and griping. It is given to overcome habitual constipation, as a derivative purgative in affections of the head and also in some other cases. It is usually a safe medicine for children, but care must be exercised, as overdoses may give rise to purging and inflammation. The secretions of the intestinal canal are increased by jalap, while the researches of Doctors Rutherford and Vignal have demonstrated that jalapin excites the flow of bile, and Bartholow in "Materia Medica," page 468, says, "With proper attention to the conditions in which it is admissible, and to the dosage, jalap is entirely safe, and is a very certain and effective cathartic," and recommends the aromatic syrup of rhubarb as a suitable medium for giving it to children.

Jalap is almost altogether imported from Vera Cruz, and some idea of the value of the trade may be gained when it is considered that the annual imports, into England alone, varies from 180,000 to 200,00 lb., realising from 1s. to 1s. 9d. per lb. according to quality.

Besides the true jalap the roots of other Mexican plants of the same natural order are employed either as substitutes or adulterants. The two following are the best known, although several others are used, viz., light jalap and tampico jalap. The first is also called Orizaba root, and is the male jalap of the drug trade or the *Purgo macho* of the Mexicans. It is the root of *Ipomœa orizabensis*, Ledanois, a plant found on the sides of Orizaba, and very nearly allied to true jalap. The second, called in Mexico, *Purga de Sierra Gorda*, growing on the mountain of that name, as well as near Oaxaca. This plant has been described by Hanbury as *Ipomœa simulans*, and is closely related to the other two, but differs in having a bill-shaped corolla, and pendulous flower-buds.

In conclusion, it may be pointed out that, according to Bentley and Trimen in "Flora Medica," the jalap, "as an ornamental plant has considerable claims to notice," its purplish-violet flowers and bright green leaves rendering it a plant well worth cultivating for covering fences and other unsightly objects.

Dill (*Anethum graveolens*, Linn).

This is an erect annual or biennial plant, which is a native of Southern Europe, Egypt, Palestine, and the north of Africa, but is now cultivated in England, France, and many widely-separated localities, such as Norway, North America, Cape of Good Hope, and was found growing abundantly in the Bermudas by the "Challenger" Expedition. It is extensively grown in these countries for its aromatic fruits, which are used in medicine and confectionery.

It is a plant of the Natural Order *Umbelliferæ*, being related to several others used as condiments, as caraway and cumin, and also to such useful plants as the carrot, celery, and parsley.

Dill is commonly regarded as being the *anethum* of ancient Greek writers, as well as being the plant mentioned by that name in Matthew xxiii, 23 (but translated from Wickliff downwards "anise") as being one of the garden plants on which the Pharisees paid tithe, making a display of paying on an humble crop, while they neglected larger and more important objects. It is also mentioned by Pliny as a condiment (Nat. Hist. xix, 61 and xx, 75).

Dill, as well as fennel, coriander, and cumin, was in frequent use in Britain in Anglo-Saxon times, and in the "Herbarium Apuleii," about 1050, as also in the "Book of Leechdoms" it is noticed. The common name is derived, according to Prior (Popular Names of British Plants, 1870), from the old Norse word *dilla*, to dull, in allusion to the carminative properties of the fruit or seeds; and we find the words "dill" and "till" used in this sense in the tenth century by Alfric, an Archbishop of Canterbury, and also in Germany and Switzerland as early as the year 1000 A.D.

Dill may be easily grown from seed sown in the spring, and produces seed abundantly. Any good garden soil will suit for its cultivation. The ground should be worked as fine as possible, and the seed sown in drills. As the seed is small it should not be sown deeply. In this Colony the beds or drills will require to be gently watered and kept very free from weeds. As the plants are of upright habit they may be allowed to grow fairly close together, but should not be too much crowded; the drills are best about 18 inches apart, which gives room for hoe cultivation. The flowers will appear in the end of November or beginning of December, and are soon succeeded by the heads of seed. These heads should be cut off before they are too ripe, else a quantity of the seed will be cast and lost, and as soon as gathered are to be spread on a sheet in a dry and well-ventilated room, when they may be rubbed up to separate the seed from the stalks. It can then be winnowed or sifted out at leisure, and packed in calico bags as soon as perfectly dry.

The whole plant is aromatic, but the part used in medicine is the fruit; these are about one-sixth of an inch long, oval, flat, and surrounded with a membranous border; they are of a brown colour, the border being somewhat paler, of an agreeable aromatic smell and taste.

The preparations in use are dill water and oil of dill. The British Pharmacopœia recognises only the oil distilled in Britain from dried fruit. It is of a pale yellow colour, with a pungent odour and a hot but sweetish taste. The yield is about 3 per cent. The oil has a specific gravity of from ·977 to ·900. Dill water is prepared by putting 1 pound of the fruit into 2 gallons of water and distilling off 1 gallon. Both the water and the oil are used as carminatives, and to relieve flatulency, colic, and hiccough, the dose being a teaspoonful of the water or one to two drops of the oil, on a lump of sugar, for an infant, and five drops of oil or from ½ to 1 oz. of the water for an

adult. Dill water is also used to cover the unpleasant taste of other medicines, particularly the various sodas, as Epsom and Rochelle salts.

The plant is largely grown in various parts of India under the local names of *suva* or *soyah*. It there grows to a height of from 2 to 3 feet, and was consequently regarded by Roxburgh as a distinct species, which he named *Anethum sowa;* but the Indian plant has no botanical characteristics to warrant its separation from the common and officinal dill of Southern Europe. The seeds are much used in India for culinary purposes, forming one of the ingredients of many native dishes and curries.

Although known for such a long time, there is but little legendary lore attached to dill; it was, however, supposed to excite the passions when boiled in wine, but it is probable that the excitement arose from the wine more than the boiled seed; and it had also the reputation of counteracting the enchantments of witches and sorcerers, as an old poem has it,

> "The vervain and the dill
> That hindereth witches of their will."

The Sugar-cane Disease.

By Dr. G. Kottmann, Ph. D.
Inspector of Mills, Colonial Sugar Refining Company.

The following memorandum was prepared for the General Manager, and is now sent to us, through the officers of the company, for publication, and we have much pleasure in giving it the publicity of our columns:—

[Memorandum.]

I now submit for your consideration the conclusions to which I have come with reference to the sickly condition of some of the cane on the Clarence and Richmond Rivers—conclusions formed on impressions received during my two recent visits to these districts, such visits, however, not having been of sufficient duration to enable me to make exhaustive investigations.

I may commence by saying that the cane which has been affected on the Clarence does not in all cases present the same symptoms; in some fields the cane dies off from the top in a similar way to the stoppage of growth caused by the checking of the arrow; in others, in place of the ordinary top is a bunch of leaves growing in a fan shape, and springing from a joint studded with buds, below which there are a few joints which have not developed any. In the former case the cane is said to be suffering from "the disease," while in the latter the cane is reported to be attacked by Sereh, this name having apparently been selected for want of better knowledge on the subject. Sereh, as will be remembered, is the name given to the disease which in recent years committed great ravages in the canes in Java. It is really the native name of a bush grass growing in Java, and was adopted because the cane suffering therefrom produced leaves without stalks which resembled this grass. The cane on the Clarence does not present such an appearance; and, moreover, the highly-trained scientific men who have been occupied exclusively for a number of years in Java investigating the condition of the disease there have not, to my knowledge, ascertained what Sereh actually is.

As to the origin of the sickly condition of the cane here, which I shall henceforth refer to as "the disease," some observers have contended that it is due to injury caused by insects or fungi, or other untoward influences; but, although I am not in a position to assert positively that this is not the case—as such an assertion can only be made after patient investigation by entomologists, pathologists, and chemists—I can say that I believe the disease has not been caused by untoward influences such as those named, but that it is the natural consequence of many series shortcomings in the cultivation, aggravated by the unusual rainfall for the last few years; in other words, I believe that the disease can be avoided, and that its occurrence will prove to be not without advantage to the farmer if he profits by the warning he has received.

In my investigations I examined the roots of stools of healthy and diseased canes, and found in all cases that the root development of the latter was much more on the surface and weaker than that of the former; thus the healthy stools were found to send a dense network of roots down to about 20 inches or more from the surface, while the diseased cane showed a close network of roots only near the surface, and not to a greater depth than from 10 to 14 inches, from which I came to the conclusion that any condition favouring the development of the roots close to the surface only assisted the spread of the disease. In support of this statement I would point out that the cane has been most affected on land having a subsoil of heavy clay or on ridges with a subsoil of sand. The unusually wet seasons since '87 have been injurious to both, the former being in a measure swamped by heavy rain, while the latter has had the fertilisers washed out, on account of the low retentive capacity of sand for these, thus causing the roots to develop mainly near the surface. The cane therefore had to draw the nourishment from a limited layer of soil, and in addition, in dry weather, it would, by reason of the absence of moisture, find but little nourishment where the roots had spread. The unfitness of the subsoil for the development of roots may also explain the slight appearance of the disease on a farm at Carr's Creek, which, though the proprietor appeared to take little notice of it, at the time of my visit was causing some alarm elsewhere, the owner stating it as his opinion that the outturn of the crop was thereby scarcely interfered with. On examination it was found that under a first-class surface soil of about 14 inches depth there was a hard subsoil of more sandy appearance into which only a few roots had penetrated. The land had been under cultivation—probably very shallow—for about twenty-five to thirty years, the owner relying on the flood deposits to produce good crops. At another farm on Carr's Creek the slight appearance of disease was by a neighbour attributed to the stools having been much shaken by a gale, which would injure the roots at some depth—a fact which may be well worth mentioning. On the Richmond where the disease has not manifested itself to the same extent as on the Clarence, like causes seemed to obtain.

Such being the conditions prevailing more or less throughout the affected districts, I have the less hesitation in saying that defects in the system of cultivation practised are in the cause of the appearance of the disease, these being chiefly want of proper drainage, shallow cultivation, exhaustion of the vegetable matter of the soil, and, to crown all, an astonishing carelessness in the selection of cuttings for plants.

As to the drainage, I may say that there are fields of cane on these rivers which for weeks and even months of this and preceding years have been literally swamped, and it is generally remarked how little has yet been done towards draining the low parts of the farms, though in most instance there are ample facilities in the way of creeks and other water-courses for receiving the surface drainage, while it is now understood that the Roads Department offer no objection to drains be taken under the roads to the river where these are properly constructed, which then would afford in most cases the greatest fall from the lowest point of the farm.

In regard to the shallow cultivation, it will be found when correctly measuring the average depth to which the plough has penetrated that this is not more than 5 or 6 inches. Only a small layer of the surface soil is thus kept in a loose condition, while, except on land of unusually good quality the air cannot penetrate to any extent below this depth, and thus sweeten the soil and render soluble its dormant fertilisers; in other words, the plant has to draw its supply of food from the surface, whence it practically receives

none in dry weather. In addition to this the small depth of soil that is loosened reduces the soakage capacity, so that a slight rainfall is sufficient to swamp the land, and by souring this, seriously injure the roots of the canes. I do not advocate a sudden change from shallow to deep ploughing, as by the latter method dead soil would be turned up, which for some time would give a very bad yield; but the air can be given access to the lower layers by subsoiling, and much more cheaply than if the land were ploughed very deep, such subsoiling, besides sweetening the lower layer and rendering it more easily penetrated by the roots of the crops, would also serve to remove the surface water rapidly, and this work could easily be done with an ordinary plough by removing the mould board and fitting on a narrow share instead of the ordinary one, which is rather wide for the work.

Then as regards the restitution of vegetable matter to the soil, the importance of this will be recognised when it is remembered that it is this matter that makes the soil loose, and thus allows access of air, and provides channels for the escape of surplus water; besides supplying carbonic and organic acids, which make plant-food available from otherwise sterile soil, and, in addition, increases the capacity of the land for absorbing and retaining water. To what degree vegetable matter serves the last-named purpose may be seen from the following figures :—

Decaying vegetable matter or humus has been found to absorb 180 per cent., grey clay 70, and pure sand 25 per cent. of their own weight of water. When exposed to the air for some hours at a moderate temperature humus was found to lose 20, grey clay 32, and sand 88 per cent. of the water thus absorbed. Humus, therefore, will soak up seven times the quantity of rain that pure sand will, and two and a half times as much as grey clay will; and when dried under certain conditions it will still contain 144, grey clay 48, and pure sand not more than 3 per cent. parts of water for every 100 parts of their own weight. Although vegetable matter or humus therefore ranks as one of the main safe-guards for the sound growth of cane, especially in a somewhat capricious climate like that of New South Wales, with alternating heavy rains and protracted droughts, the system of cultivation on the Northern rivers has been such as to convey the impression that the aim of the farmers so far has been to get rid of the humus in the shortest possible time. The trash has always been religiously burned, and all that has been restored to the soil in the shape of vegetable matter are the poor remnants of the burnt trash, and of occasional maize crops and weeds. It will be interesting to the cane-growers of the northern districts to hear that the trash is not burned in Cuba, which is the largest producer of sugar from cane. The trash is there put between rows, and assists in keeping down the weeds by smothering them. The cane is ratooned from one plant for ten years or more, and that this is possible I attribute greatly to the beneficial effect of the organic matter in the trash, rich as that soil in the first instance is. Though I believe in the saving of the organic matter in the trash before ratooning, by shifting the latter on every alternate bank and cultivating the clear banks, I would go so far as to say that burying the trash is the best course to adopt when ploughing out. Certainly it is much better than doing nothing at all in the way of returning organic matter to the soil, but it cannot do as much good as green manuring; and, in case both cannot be done, preference should be given to the latter. The green manuring crop, when made to grow vigorously, supplies more valuable fertilising matters than the trash, and it is unwise to leave the soil when bare exposed to the hot sun and heavy rains of a semi-tropical climate, which will tend to reduce its fertility. Green manuring is a most excellent means of returning vegetable

matter to exhausted soil, and thereby restoring that which gives its principal value to virgin land. The American cowpeas have of late come into prominence as a superior seed for green manuring. They are regularly used by sugar-growers of Louisiana during the fallow they give between ploughing out and planting, and will, I hope, in the early future be largely used in the same way in New South Wales. There is not, however, a sufficient quantity of seed yet available for practising green manuring with this crop on a large scale, and we must therefore look out for a plant that can at once be made to serve this purpose. This is maize. Though not assimilating as much nitrogen from the air as cowpeas, it has been found to answer well for green manuring in Fiji, when sown broadcast, on account of its heavy and sure growth, and it is easily ploughed under when between 3 and 4 feet high. It will then soon rot, and does not in any way interfere with the subsequent cultivation, and indeed it will often be possible to sow two crops between ploughing out and replanting, a course that can be much recommended.

It is chiefly, however, the carelessness displayed in the selection of cuttings for planting that has brought about the present trouble. The farmers frankly admit that they have often taken plants from the poorest cane on the farm in order to save the good cane for the mill. If, therefore, disease appeared in the cane on the farm as a consequence of a bad system of cultivation, or, for argument's sake, owing to untoward influences, the farmers were certain to propagate it. It may be assumed that the mistake having been recognised, will not be repeated, and the energetic measures recently taken to procure sound cuttings for the infested districts of the Clarence will go some way to produce an improvement; and in connection with the selection of plants, it may here be mentioned that all stalks or tops of stalks with bulbous or sprouting eyes should be rejected instead, as has been done here and there, of being preferred on account of their being likely to sprout quickly. The planters in Java were very particular on this point in 1888, when preventive measures were taken against the sereh, and they only allowed plants to be selected with small tight eyes that were pressed close to the stalk, unsoundness of the cane usually manifesting itself by the sprouting of the eyes near the top. It is, of course, a different thing when the eyes are made to sprout by bedding or pitting the plants for some time in small heaps under trash. This, when carefully done, has given satisfactory results on the Clarence, and the farmer who tried it successfully advised that the beds or pits be distributed over the land to be planted, in order to avoid injury to the beds during transport. This method allows also of a selection of plants which will sprout from those that will not, and is largely adopted in Mauritius.

During my last visit to the Clarence I found that those of the leading farmers on the lower river with whom I had the opportunity of conversing on the subject are quite aware that the old system of cultivation must be changed, and have already taken steps to improve the drainage and to plough deeper, while they also declared themselves ready to try subsoiling and green manuring with maize on land that will be ploughed out after the end of the crushing season and replanted next season, and not to let land lie under a bare fallow; and it is to be hoped that the disease of the cane will be dealt with in this spirit by the majority of the farmers.

I must, however, point out that nothing was said at the meeting held at Chatsworth on the 22nd of November last to discuss the question of the disease of the cane indicating that the farmers attending this meeting realised the need for selecting plants and for improving the cultivation, nor did anyone draw attention to the fact that the appearance of the disease on virgin

land was due to the use of unsound cuttings, or that the comparative exhaustion of much of the frontage land on the Clarence by continuous cropping without manuring other than that given by the floods, and the setting of the subsoil by the ploughing of the surface, offered strong reasons for a marked change in the system hitherto adopted of working the land. Till such changes are made the crops are bound to be sickly and inferior, and the so-called disease will spread unless the farmers generally face the position as did the planters in Java, when the sereh caused such serious damage. These men, though they summoned to their aid the most scientific skill they could command, did not sit down to wait for a description of the disease and of the possible cure; they went vigorously to work to improve their cultivation in any way that seemed possible, especially with regard to discretion in the use of irrigation water, the loosening of the soil over the whole area instead of only in the plant furrows, the return of more vegetable matter to the land, &c., and then made arrangements for procuring cuttings from the hills, where a healthy stand of cane could be procured, with the result that before the scientific men are satisfied as to the cause of the trouble the latter has already been diminished, and the production of sugar again shows signs of a healthy increase. And this was done in a country where some details of the cultivation were so carefully done that the cane-fields were called "gardens," and rotation of crops was strictly enforced. Let the farmers of New South Wales follow this example, and there will soon be a change for the better.

I may mention in conclusion that the appearance of disease in the cane is not a novel experience in New South Wales, for I learn that nearly twenty years ago two purple canes then grown on the Clarence were destroyed by disease. A similar fate met the Bourbon cane at Mackay and in New South Wales, and at a late period it was found necessary to discontinue altogether the planting of ribbon cane, though such action appears to have been taken mainly because the other varieties promised to yield a better crop."

Cold Storage of Fruit.

THE following Report was made by Mr. A. H. Benson, Fruit Expert to the Department:—The recent experiments in the cold storage of fruit at the Government meat markets, Darling Harbour, which, as intimated in our issue of October last, were carried out under the supervision of the Department of Agriculture on lines suggested by Mr. W. E. Shoobridge, of Bushy Park, Hobart, Tasmania. This gentleman recently visited Sydney for the purpose of getting the Governments of New South Wales and Victoria to join with the Government of Tasmania in sending a trial shipment of fruit to England in a vessel, the hold of which shall be thoroughly ventilated with cool air, instead of placing the fruit in the cold chambers used for the conveyance of frozen meat, as is done at present. Messrs. Hudson Bros. kindly placed a cool room at the disposal of Mr. Shoobridge, by whom the preliminary experiments were carried out, as described in the *Gazette* above referred to. Mr. Shoobridge has given a very great deal of attention to the export of fruit to England, and in order to determine exactly how the fruit kept and the condition in which it arrived in England, he accompanied a consignment of apples from Tasmania to London. The result of his experience is that in every case where the fruit is placed in the cold chamber used for the frozen meat trade there is always a loss, arising from the want of ventilation with fresh air and the consequent condensation of moisture on the fruit, especially that contained in the lower cases. He also noted that the fruit ripens very much faster during the voyage than is the case when stored in Tasmania, even though the temperature was kept considerably below that of the average winter temperature of Tasmania; and this he also attributes to want of ventilation. The experiments were conducted from the 27th of August, when the first fruit was placed in the cool room, to the 7th of December, when all the fruit then in the room was sold. The fruit stored was confined to oranges, emperor mandarins, and lemons, all of which were wrapped in tissue paper and packed in ordinary fruit packing cases, after having been allowed to remain for a few days in an airy place to thoroughly dry the fruit from all excessive moisture in the skin, and to help to toughen the skin and render it thus less liable to bruise in transit. The fruit was generally very unsuitable for long keeping, as the emperor mandarins were very puffy, and consequently difficult to keep or handle, on account of their being so easily bruised. Many of the oranges were covered with scab and otherwise injured, which prevented their keeping; and lemons do not require cold storage and keep much better without it if only properly handled, and cured in accordance with the instructions issued in Part IX, vol. III, "Preparation of the Lemon for Market," of the *Agricultural Gazette*. In order to substantiate this statement I may say that on August 4th I cut a case of lemons from the orchard of the late Mr. E. H. Acres, of Baulkham Hills, which when examined on December 6th, were found to be in perfect condition—only one lemon showing any signs of decay; and these

lemons have been stored in one of the offices of the Department and subject to all the changes of temperature. Mr. Cairns, of Parramatta, has also lemons cut about the same time and stored in his cellar, which are in first-class condition, and which were pronounced by a large English fruit merchant to be the best lemons he had seen in the Colony, and to be exactly suited to the English market.

The original experiment, as devised by Mr. Shoobridge, underwent several modifications, as it was not found to work satisfactorily. The ventilation was insufficient, and the temperature was only kept down by opening the door leading from the meat-room to that in which the fruit was stored, and allowing the cold air to get in. The butchers who had hired chambers in the meat-room from Messrs. Hudson Bros. complained of this, as they said the smell of the fruit was spoiling their meat. The fruit was, therefore, removed to another room on the 27th of September, which was not fitted up with any means for keeping the temperature down, and remained till the 8th of October exposed to the ordinary outside temperature, which ranged from 58 to 66 degrees. The average temperature previous to the removal of the fruit from the cold room was 48·5 degrees from 27th August to 7th September, and 50·3 degrees from the 7th to the 27th September.

On 8th October it was finally placed in a cool room that had been specially prepared to receive it, and in which the temperature was brought down to 45 degrees by means of cold air and a coil of brine pipes inside the chamber.

The outer air was cooled by being passed over a coil of brine pipes placed inside an insulated box on the outside of the cool chamber in the market. The outer air entered at the top of the box and passed over the pipes, and thence into the cool room, the in-draught being produced by a torpedo cowl placed on the top of a ventilating shaft connected with a ventilator placed in the centre of the ceiling of the cool-room. The cool air was thus drawn in at the bottom of the room and the warmer air was drawn off at the top. This gave a sufficient amount of ventilation, but was only a partial success as the cool air was not sufficient to keep the temperature low enough, especially on the side of the room opposite to that at which it entered. In order to obviate this a coil of brine pipes was introduced into one side of the room, and the cool air entered at the other. This proved very satisfactory, as while there was always good ventilation the temperature was maintained very evenly. From October 8th to November the 7th, a period of 31 days, the average minimum temperature was 41·4 degrees, and the average maximum temperature 45·2 degrees, or a mean average of 43·3 degrees, which I consider highly satisfactory.

Owing to the condition of the fruit when placed in cold storage, and the changes of temperature it underwent during the progress of the experiment, and also on account of its having to be moved out of the chamber and repacked at least twice to remove spoilt fruit, I consider that the fruit kept remarkably well. The experiment has demonstrated conclusively that the temperature can be maintained evenly and low enough with a constant influx of cool, fresh, comparatively dry air. This can be done at a very cheap rate, and it should be of great value in the export of fruit, as by similar means the hold of a vessel could be cheaply fitted up so as to carry fruit better and cheaper than when carried in the freezing chambers, when, in addition to a very heavy freight of 4s. 6d. per case, there is always more or less loss owing to the condensation of moisture on the lower cases of fruit. With ventilation this condensation is prevented, as the whole of the aqueous vapour is drawn off by the exhaust fan through the ventilator shafts. In the cold storage of fruit one precaution will, however, have to

be carefully taken, and that is, the temperature of the cold room will have to be gradually raised from that of the cold room to that of the outer air as, if taken at once from a cooler to a warmer temperature, there is always a heavy condensation of moisture from the atmosphere on the fruit which causes a rapid decay to set in, as well as entirely spoiling all the papers used to wrap the fruit. If the temperature is, however, gradually raised, this will be entirely prevented. The success of the experiment is mainly due to Messrs. Hudson Brothers, who did everything in their power to assist the Department, and to the gentlemen who sent their fruit for storage.

Subsequently, on the 4th January last, Mr. Benson paid another visit to Darling Harbour, where Mr. F. W. Hudson was kind enough to agree to the cool chamber being used by the Department for the conduct of storage experiments with soft fruits, such as apricots, peaches, pears, plums, grapes, &c.

In regard to the fruit stored during the previous experiment an account sales handed to Mr. Benson shows that in Melbourne 36 cases of oranges realised an average of 8s. 7½d. per case, which, taking into consideration the difficulties explained in the above report, must be considered a highly satisfactory result. Moreover, at the time they were first placed in cool storage they would not have realised more than 3s. a case at the outside.

Report on the Frozen Meat Trade of New Zealand.

By ALEX. BRUCE,
Chief Inspector of Stock.

I HAVE the honor, in compliance with the instructions I received from the Hon. the Minister, to make the following report on the frozen meat trade of New Zealand; and, in doing so, I desire to acknowledge the assistance I received in collecting materials for my report from Mr. J. D. Ritchie, Secretary of Agriculture, and Mr. Thos. Brydone, general manager of the New Zealand and Australian Land Company, Dunedin; and to notice in passing that New Zealand owes a great deal of its progress to the able management of the directors of that company of their extensive properties, and the sound judgement, energy, and practical knowledge of agricultural and pastoral matters displayed by their general manager during the twenty-five years he has held that appointment. In the first place it was largely through the company, under Mr. Brydone's advice, that more than twenty years ago an improved system of tillage, and the growth of roots and grass crops was introduced, whereby an excellent system of rotation of crops (a thing, I am sorry to say, almost unknown to this Colony) was adopted, and the fertility of the land maintained, while heavy lots of prime fat sheep have been turned off at 18 to 20 months old, at prices ranging from 15s. to 19s. each. To enable this to be done, the breeds of the best sheep have had to be introduced, and the breeding and quality, both as regards mutton and wool, has had to be maintained; and this, too, has been so well and successfully carried out in the company's flocks of the leading breeds of longwoolled sheep, that they are held in general estimation throughout the Colony, and their rams meet with a ready sale.

The next matter was the successful initiation of the frozen meat trade, and that Mr. Brydone, under directions from his directors in London, and the information he received in this Colony (where the first attempt was made by the late Mr. T. S. Mort), successfully accomplished when the first cargo of frozen meat from New Zealand, consisting of some 4,000 sheep and 600 lambs, which had been killed on one of the company's stations and frozen on board the sailing vessel "Dunedin," was delivered in good order and condition in London in the beginning of 1882, and realised the handsome price for sheep and lambs of 6½d. per lb. In alluding to what this company has done for New Zealand, I think I may add that they were the first (in 1882) to establish a dairy factory on their property at Edendale, and now there are over 100 in that colony doing well, and turning out large quantities of excellent butter and cheese.

My object in making this statement in regard to the work done by the New Zealand Land Company is twofold—(1) to give credit where it is fairly

due, and (2) to induce the owners in this Colony, who hold good country, with a rainfall and climate similar to that of New Zealand, to adopt, as far as possible, the New Zealand system of tillage, stock-breeding and fattening, and export of meat. And although the circumstances are, perhaps, not so favourable in this Colony for the adoption of that course as in New Zealand, yet I have no doubt that many of our owners in the colder and more temperate portions of the Colony will be able to adopt the New Zealand system, and the breeding of crossbred sheep; and that will materially assist in establishing an export trade in frozen mutton. I will now proceed to state as briefly as I can how the frozen meat trade was established in New Zealand, to give some account of its extent, and to say how it is conducted.

1. How the New Zealand Frozen Meat Trade was Established and Companies formed.

The trade was initiated, as already stated, by the New Zealand Land Company, and it was fully established by the formation of joint stock meat companies. As there was an over-abundant supply of fat sheep in New Zealand when the first shipment of frozen meat was made to London (that colony was then, as ours now is, suffering from glutted markets and low prices), and as the prices obtained for the first shipment were very remunerative, the natural result followed. Joint stock meat companies, in which not only stock-owners, but it may be said all classes of the community took shares, were formed. Freezing works were, in the course of a few years, erected in most of the districts where fairly steady supplies of fat stock could be obtained, and shipping engaged to carry the meat to London, and, so successful has the trade been generally, that while there are now twenty-one freezing depôts at work, with an output of some 2,000,000 of fat sheep a year, there are only three or four companies where even the shareholders who own neither sheep nor cattle, nor have any direct interest in stock, have not regularly received at least fair interest for the money they have invested in these companies; while those shareholders who are stock-owners have, in addition to their dividends, benefited to an enormous extent through the rise in the price of fat sheep—for sheep which in 1882 were bringing only 7s. 6d. and 8s. 6d. are to-day selling at from 16s. to 19s. each at the freezing works.

As it is naturally a matter of considerable interest to our stock-owners who, it may be said, have been endeavouring unsuccessfully for the past ten or twelve years to form companies for the export of our surplus meat, to learn how such companies were successfully established in New Zealand, I would explain that in that colony the course generally adopted was for those who moved in the formation of the company to obtain a guarantee from the stock-owners in the district that they would annually supply a certain number of fat sheep for shipment. On this being obtained, a prospectus, bearing the name of gentlemen in whom the stock-owners and the public had full confidence as provisional directors, was issued, showing that the undertaking would be a paying one; the public were invited to subscribe the necessary capital, and the company was soon formed, for, as already explained, almost all classes in the community took shares. The guarantee given was necessary, principally because freight was comparatively scarce, and the shipping companies insisted upon a guarantee being given by the meat companies as to the number of sheep which would be shipped before they would undertake to call at any of the ports and take the frozen sheep.

As it turned out, however, this guarantee entailed no risk, for space on board ship was very shortly at a premium (each shareholder was entitled to so much space in proportion to his shares), and as much as 2s. 6d. per sheep was in early days paid for space, which, of course, the greater part of the shareholders could not use themselves. The fact is, the business proved a remunerative one, and it was seen, too, that the supply of fat sheep could not only be maintained, but increased, for, situated as New Zealand is, with land and pasture as good as any in the world, a favourable climate, with sufficient rainfall, large numbers of the very best mutton-producing sheep, and thoroughly reliable practical business men to manage these companies, the people taking shares had every confidence that the investment they were making would be both a profitable and lasting one; and they have not, except in a few cases, been disappointed.

II. The Freezing Works in New Zealand, their number, position, and capabilities.

There are twenty-two meat-freezing works in New Zealand, including one in course of construction. Of these thirteen are in the North Island, and nine in the South. These companies are all of colonial origin, though some of them, such as Nelson Brothers, are believed to be assisted by English capitalists. This firm, it is said, owns four or five of these works, and largely controls the business of three or four other companies, and they also act as agents in London for several of the others. It will thus be seen that this company have a very large say in the conduct and management of the frozen meat trade; and, notwithstanding the very great deal of good they have unquestionably done both in New Zealand, and are also doing in this Colony, there is a feeling there as here that the formation of additional companies with capital and enterprise like theirs would be to the advantage of stock-owners in both colonies.

To the great body of our stock-owners it will be a matter of surprise to learn that in a colony with such a comparatively small area as New Zealand, and with less than one-third of the sheep in New South Wales, so many freezing works should be established, and this feeling will be increased when they are informed that in the portion of New Zealand fairly stocked with sheep these works are to be met with not more than 60 or 70 miles apart, while in or near Wellington there are no fewer than three different works, near Christchurch two works, and in the vicinity of Napier two works. Of the twenty-two works alluded to, twelve of them were visited by Mr. Gordon and myself, and the following are the places at which the works have been erected:—In the North Island: Auckland, Gisborne, The Spit (Napier), Tomoana, Waipukarau, Woodville, Waitara, Patea, Wanganui, Wellington, Nghauranga, The Gear. In South Island: Belfast (Christchurch), Nelson, Islington, Timaru, Oamaru, Dunedin, Milton, Matura, The Bluff. Of these the first erected were the works at Bernside, Dunedin, then those at Christchurch and Wellington, and afterwards those at Napier, Tomoana, Timaru, Oamaru, and Invercargill in the order in which they are mentioned.

III. Capabilities of the Works.

From the statements received it would appear that the works at the places stated, with capabilities ranging from 300 to 1,600 sheep per day of twelve hours, can freeze from 12,000 to 13,000 sheep in a day, which would be equal to about 4,000,000 a year. This is considerably more than the cast of

fat sheep and lambs in the colony would actually require to be provided for. But the necessity for this additional space arises, of course, through the sheep not being sent to the works day by day during the year in regular numbers, but irregularly as the owners require to part with them, and, of course, in very much larger numbers at one season of the year than another. This irregularity in the supply of sheep coming to the works has also to be met by night work, and a good few of the works are provided with electric lighting to enable the freezing and loading to go on by night when required.

IV. The Kind and Cost of Building and of Works.

As a rule the buildings in New Zealand erected in connection with the meat works have, with the exception of the freezing chambers in some of them, been constructed of wood and at a comparatively small cost, and they have answered the purpose as well as more expensive brick or stone buildings, while the first cost has been very much less, and any alterations which have afterwards been found necessary have not entailed much expense. To show how economically they go to work in New Zealand, it may be stated that the estimate quoted to us for a complete set of works to deal with 1,000 sheep and their offal in a day of twelve hours was from £17,000 to £20,000, and such a set was understood to include a railway siding, receiving, and chilling rooms, freezing chamber and cold store, with engine, freezing machine and plant complete, shed for running and preparing the offal, rendering room and digesters and tallow house, shed for fellmongering, wool scouring, wool drying, and wool packing, and a building with engine and plant for desiccating the offal as it comes from the slaughterhouse and converting it into a portable manure.

It is scarcely necessary to point out the very great difference it makes to the returns from a company with works constructed in this complete and still very economical manner, compared with some which have lately been erected in Queensland, two of which, it is said, cost, £150,000, or even compared with works constructed in this Colony at a reputed cost of £40,000, which have very much less accommodation for dealing, as is done at the principal works in New Zealand, with both the stock and the whole of the offal, so as to turn that which is largely a perquisite of the company to the best possible account. But this is not all. Refrigeration is still in a transition state, and this fact should be borne in mind in the erection of such works, for alterations in the buildings and machinery cost considerable sums, and the less expensive the buildings are the less outlay will be entailed should alteration be necessary. In giving the estimates quoted of the first cost of such works, they are calculated on the understanding that the machine used would be the Haslam Cold Air, and if the ammonia machine proves, as it is believed it will, a thorough success, then the estimate would be from £2,000 to £3,000 less.

V. Best Site for Works.

Provided sufficient water can be obtained (say, from 4,000 gallons to 5,000 gallons an hour), the best site for meat works—so far as the saving of time, labour, and expense in carrying on the works is concerned—is on a rising ground, for not only can the sheep in that case be passed from hand to hand and from place to place by gravitation as they are dealt with, but the whole of the offal can be handled in the same way, if the buildings on which the different portions of the work are done be set down in the right positions

and proper arrangements made for its despatch; and if the site of the works is such as to admit also of the mutton and all the different portions of the offal being, when they are ready to leave the works, also passed by gravitation to the railway trucks or lighters—all which is possible—then the site is an excellent one. Where a natural elevation cannot be obtained the buildings can be raised and the sheep driven up to the slaughter-house; but this, of course, entails additional expense, while some of the branches of the works cannot be so conveniently carried on as if the elevation was a natural one. It will be noted that sites of the same description should be selected for killing and chilling depôts.

A great deal has been said in this Colony about the necessity for having freezing works right on deep water, where ocean-going vessels could come close up to the works and load the frozen meat. But, while this would no doubt be a great advantage if it could be obtained, the fact is that so far as regards New Zealand there are only one or two instances in that colony, if there be that, of freezing works alongside which the large steamers now loading frozen mutton can come and take the mutton direct from the works into the vessel. In almost every instance the mutton is lightered to the vessel which is to convey it to England, and that, too, in several cases after having first been conveyed from the freezing works, situated at shorter or longer distances from the port, by the train to the lighter—in one instance close upon 100 miles. Nor is this all. The steamers in some cases anchor in open roadsteads, and at times have on account of the weather to leave before the loading is completed. Supposing, therefore, that the lower floor of the Darling Harbour meat market were, as proposed, converted into a freezing and storage room, and the mutton sent down from the up-country killing and chilling depôts were sent there and frozen, it would be far more convenient and safer to run the refrigerating cars into the building alongside the store-rooms, load them with the frozen mutton, run them down to the ocean-going steamers at the deep water wharf at Pyrmont, and transfer it from the cars to the steamer, than to do as is done in New Zealand, in shipping the frozen mutton there for London.

VI. The System of Refrigeration.

In New Zealand the system of refrigeration adopted has, in every case, until recently, been by the cold-air process with the Haslam machine, and with ordinary care these machines have, so far as doing effective work was concerned, given thorough satisfaction. But the system is a comparatively expensive one to work; and if what has been stated to Mr. Gordon and myself can be substantiated, very much more so than the "Linde" ammonia machine, which is said to be equally efficient. I will, further on, submit a brief statement, contrasting the work done by the two machines, and the expense in each case. Latterly the Haslam has in several cases been supplemented by an ammonia machine, to chill the meat before it is transferred to the freezing chamber to be operated on by the Haslam. The arrangement is likely to become general, for it is both safer and more economical, in so far as when the meat is properly chilled to the bone before being sent to the freezing chambers, there is no risk of bonestink, and refrigerating costs considerably less under the ammonia system than the cold-air process.

Recently another cold-air machine, the "Goodfellows," has been brought out and erected in two or three of Messrs. Nelson Brothers' works, and is said to be a considerable improvement on the Haslam. Within the last twelve months, again, a "Linde ammonia machine" has been erected at the

new freezing works at Nghauranga, near Wellington, and when inspected by Mr. Gordon and me was doing very satisfactory work, and, as was represented to us, at much less expense than the Haslam. The following comparative statement of the expense of working the two machines, furnished by one of the agents of the "Linde," would seem to bear out the favourable results claimed for that machine:—

Linde.	Haslam.
Sheep per day, 1,000	Sheep per day, 1,000.
Fuel per day, 3 tons.	Fuel per day, 12 tons.
Labour in 24 hours, 5 men.	Labour in 24 hours, 8 men.

That gentleman stated, too, that it has been shown from independent tests, thoroughly carried out, that the "Linde" machine only requires, for the same amount of cold produced, from one-fourth to one-fifth of the fuel necessary for cold air machines.

The result of the comparison here given of the two systems, if it be only approximately correct has most important bearings, for if the superiority of the "Linde" machines can be substantiated to anything like the extent there shown, and it is found to be sufficiently powerful for freezing as well as chilling, and if the meat frozen by the ammonia process looks and keeps as well as that frozen by the cold air, then the ammonia is evidently the machine to use. And the latest accounts received from Wellington (New Zealand), and from Melbourne, where these machines are now at work, are very favourable, and would seem to confirm, to a very great extent at least, the statement here given showing the great economy of the "Linde" machine over the "Haslam." If further experience thoroughly confirms this information, then the economy in working will lead to the reduction of the charges for chilling and freezing preparatory to shipment.

That of itself would be a considerable boon to stock-owners, but if, as it is said, the "Linde" process is likely also to supplant the "Haslam" on board ship, that would lead to still greater reduction in the cost of sending frozen meat to London, in the shape of reduced freights, brought about of course through the great saving in the consumption of coal on board ship by working the "Linde" instead of the "Haslam" machine. Besides the ammonia machine on the "Linde" principle, which we saw at work at Wellington, we inspected another one at Patea, which was used for chilling the meat forwarded by the company killed there to Wanganui, a distance of 44 miles, and to Wellington, a distance of about 200 miles, for freezing and shipment to London. The only Carbonic Anhydride machine in use in New Zealand is that at The Spit, near Napier, which was not visited by us, as it was not working at the time. The reports with respect to it were rather contradictory. Another impression left on our minds from the information we obtained with regard to this machine was that its superior efficacy and economy over the other systems now in use in New Zealand has yet to be proved.

VII. The work done by Freezing Companies and their Remuneration.

The services rendered by these companies to sheep-owners and others who send their stock to be slaughtered, frozen, prepared for shipment and shipped, and sold in London, and the charges made for these services are the following:—Receiving, killing, freezing, and weighing, per lb. ·37; labelling, bagging, delivering alongside ship, and export dues, ·08; freight, 1·00; primage, 5 per cent., ·05; insurance against all risk, ·10; conveyance to

store, receiving, storage, delivery, and commission on sale, ·28; total, 1·88. As regards the offal, the owner gets the skins and rendering fat, while the company retains the head, tongue, kidneys, runners, blood, &c. The skins and rendering fat are generally sold on owner's account, at market rates, to the fellmongers and soap-boilers, the skins of crossbreds selling immediately after shearing at 1s. 3d. to 1s. 6d., and up to 6s., and even 6s. 6d. when full fleeced. In some cases the companies fellmonger the skins, and render the fat, and sell them on owner's account, deducting reasonable charges for the service.

At most of the works in New Zealand the sulphide of sodium, instead of the sweating process, has been adopted in fellmongering. The prices of crossbred pelts worked in that way and properly dressed, salted and packed in casks resembling tallow casks, are said, if very good, to be worth as high as 26s. per dozen (2s. 2d. each) in London. The pelts of the merinos are worth very much less, and some of them which are wrinkly are useless, and are thrown away on that account and their thinness. The best of the merino pelts are said not to be worth more than 9d. each. At some of the works we found improved appliances for drying (slipe) and wool, in the shape of centrifugal and revolving wool-drying machines. The runners, or guts, after being thoroughly cleaned, are salted and shipped to America, where they find a ready market—the larger for sausage casing, and the smaller for gut strings, &c. The tongues, again, are preserved by tinning, and the kidneys which, packed in crate boxes, are frozen, and bring from 8d. to 14d. per dozen in London. The rest of the offal the companies either give to pigs or convert into portable manure by boiling, drying, grinding the bones and other processes, and sell it at fairly remunerative prices, say from £4 to £8, and up to £10 per ton for pure desiccated blood. With proper arrangements and care in working up the offal immediately it leaves the sheep, the preparation of manure can be carried out with little or nothing that is offensive, and with a fair demand for the manure, its sale should, it is said, go a good way towards paying the working expenses of the establishment. The most complete plant we saw in New Zealand for dealing with the offal in this way was an American one imported from Chicago, at the Nghauranga works at Wellington.

VIII. The different ways in which Fat Sheep are sold in the Colony.

1. Owners at times sell their sheep on foot to the companies' buyers on the station, to be delivered at the yards there or at the works; and last year as much as 17s. 6d. to 18s. 6d. for full-fleeced 60-lb. wethers was paid at owners' yards, and which was considered better than selling at per lb. at the works. 2. They sometimes sell to be delivered at the works at prices up to 2¼d. per lb. for prime first-class Canterbury mutton dead-weight, with a deduction of, say, 1½ lb. for shrinkage in freezing, the vendor retaining the skin and the rendering fat, which are sold on his account; and in this way he would make, for full-fleeced 60-lb. wethers, 17s. 9d. at the works, which is not so good a return as No. 1. 3. They sometimes sell at 3¼d. per lb. for prime first-class mutton other than Canterbury, the purchaser getting the skin and rendering fat, which would give a return of 16s. 3d. for a 60-lb. wether. 4. They also sell at per lb. at the works, the owner retaining the rendering fat and wool, the company fellmongering the skins and retaining the pelt. Latterly, in New Zealand, owing to the competition

amongst the companies, and also among ship-owners (there were lately more ships offering than there were sheep to fill them), there has been a strong demand for sheep for freezing and export, and, as a rule, owners have found it more advantageous to sell at home rather than to freeze and ship, or even send them on to the works for sale. When sheep are sold at the works at per lb. the companies' weights are invariably taken, someone on the vendors' behalf going out occasionally to test the weights taken by the company.

They call prime fat sheep, weighing from 55 lb. to 65 lb., first-class; 50 lb. to 54 lb., second-class; 66 lb. to 80 lb., third-class; and 40 lb. to 49 lb. fourth-class. But, of course, the weight does not in all cases decide the grade, and some of those whose opinions carry weight consider that more attention should be paid in grading to the quality of the mutton than is now given, and that instead of four there should be only three classes, *i.e.*, 50 lb. to 70 lb, for first-class, 71 lb. to 80 lb. second-class, and 40 lb. to 49 lb. third-class. Sheep weighing more than 80 lb. are either sold to the local butcher or put into the boiling pots; but the hind legs of these large sheep are sometimes frozen and exported. The average prices obtained in London for frozen mutton from the time the frozen meat trade was established in 1883 till the present time are as follow:—In 1883 the price was 6¼d. per lb., in 1884 it was 5⅜d., in 1885 it was 5d., in 1886 it was 4¾d., in 1887 it was 4d., in 1888 it was 4¼d., in 1889 it was 3⅞d., in 1890 it was 4⅜d., in 1891 it was 4⅛d., and in this year (1892) it will be about 4d.

IX. Up-country Killing, Chilling, and Freezing.

With freezing works, it may be said at every 60 or 70 miles where the country is sufficiently good to keep an average number of sheep, sheep-owners in New Zealand are far more favourably situated than ours so far as marketing their sheep is concerned, for they can thus get them to the freezing works without waste or deterioration, and at very little cost, while many of our owners have to drive their sheep perhaps 100 or 200 miles, and some of them even 300 miles, on foot, and then send them 150 or 200 miles further by rail, thereby both deteriorating and wasting the mutton, and entailing heavy expense. To save this as far as possible, we propose to erect killing and chilling depots at the main centres of the stock traffic, and kill and chill, and forward the mutton in refrigerating cars to Sydney and Newcastle, where it can be either sold for local consumption, or frozen and exported.

This arrangement, which was considered thoroughly practicable, has, however, been objected to on the ground that it would not be safe to freeze mutton which had been chilled up country and brought to the seaboard in that state, even in refrigerating cars, and although the advocates of this mode of dealing with the meat pointed out that the chilling was really only a preliminary step, and a very necessary one in successful freezing, and that instead of increasing the risk of taint by chilling, that process would add to the certainty of the mutton being perfectly frozen, objection was still taken by those who set themselves up as authorities on the subject of refrigeration. I am glad, however, to say that the information obtained in New Zealand on the point thus raised is thoroughly confirmatory of the views of those who held that there is no risk whatever in killing the sheep up country, conveying them in refrigerating cars to the seaport, and there freezing them for shipment. Not only has this course been adopted with mutton, but also even with beef with perfect success. Both mutton and beef have for years

been killed at Patea, chilled, and sent 200 miles to Wellington, and what is more, at certain seasons of the year beef, as well as mutton, are sent without any chilling whatever in plain insulated cars without any ice, and frozen and shipped to London in perfect condition. The same course has been adopted, with the same results, with both mutton and beef slaughtered at Longburn, 94 miles from Wellington.

Farther than this, we had the decided opinion of Mr. William Nelson, of Temoana Freezing Works, at Hastings, 8 miles from Napier, one of the highest authorities on freezing in New Zealand, to the effect that unless we can slaughter and chill our stock near their pastures, and freeze them at the ports of shipment, we had better leave the trade alone. This is not all. While we were going over his works—one of the largest, if not the largest, in New Zealand—we found that he was adding a carbonic anhydride machine to his cold-air Haslams for chilling preparatory to freezing, and this course is, as already stated, now generally followed at all the principal freezing works recently constructed, as both the safest and most economical mode of doing the work with cold-air machines. There cannot, therefore, be the slightest risk in adopting the system we had laid out in this Colony in freezing meat which has been killed and chilled up country, and sent down in refrigerating cars to Sydney or Newcastle, and if the markets are not favourable, and the owner, instead of storing in the cold chambers and keeping for a rise in price, instructs his agents to freeze and ship, the cars can, without being opened, be run straight to the freezing works and delivered into the freezing chambers, without the slightest risk of any failure in the operation.

X. Shipment of Meat and Freight to England.

For a considerable time, although what would be considered high rates of freight were offered, it was difficult to obtain space in the vessels fitted up to carry frozen meat. So much was this the case that the space on these vessels (which by the terms of co-partnery of the meat companies was usually divided among the shareholders *pro rata*, according to the number of their shares) was at a considerable premium, as much as 2s. 6d. per sheep, and as high as 2½d. per lb. was paid at first for freight, and that too by sailing vessels. Such very high rates as these before long worked their own cure—more sailing vessels were fitted up for the trade, and by-and-by one of the companies put steamers on the line. Then other steam companies followed, in many cases with steamers of large size, and the outcome has been that the rates of freight of frozen mutton from New Zealand to London have from time to time been lowered till the rate is now 1d. per lb. Freight in Queensland is, I believe, still lower than this (13-16d. per lb.), but it is explained that this is the case because the Queensland companies have bound themselves to ship a certain quantity of meat during the year by regular instalments.

While again the rates of freight have been reduced, another change for the better has taken place. Far more vessels are carrying frozen mutton. Three fleets of steamers belonging to three different companies are now engaged in the trade, and there is now no difficulty in finding space. In fact, when we were in New Zealand more space was offering than there were sheep to fill, but it was expected that after shearing the supply of sheep would be considerably increased. However this may be, so many steamers are carrying frozen mutton that owners can get their sheep away almost as fast as they can be sent to the freezing works. Notwithstanding the large

reduction which has already been made in the rate of freight, shippers are looking for still lower rates, and as further improvements in refrigeration still continue to be made, I think we are safe in concluding that frozen meat will be carried at still lower rates. The low price now obtained in London for frozen mutton call for the freight to be reduced to the lowest rates which will pay the shipowner.

XI. The Sale of Frozen Meat in London.

The latest statement received in this Colony of the wholesale prices of the different kinds of mutton in London are:—Prime Scotch, 4s. 6d. per stone of 8lb., or 6¾ per lb.; prime New Zealand, crossbred, 2s. 10d. per stone of 8 lb., or 4¼d. per lb.; prime Sydney, merino, 1s. 8d. per stone of 8 lb., or 2½ per lb. From this statement it will be seen that the best New Zealand crossbred mutton was bringing 1s. 8d. per stone of 8 lb., or 2½ per lb., less than the best Scotch mutton; and that the best Sydney merino mutton was bringing 2s. 10d. per stone, or 4¼ per lb., less than the best Scotch, and 1s. 2d. per stone, or 1¾d. per lb., less than the best New Zealand. That is, prime New Zealand crossbred mutton was only bringing about two-thirds of the price of prime Scotch, and prime Sydney merino a little more than one-third of the price of the best Scotch mutton. With these facts before us, it is a matter of the very first importance to all the colonies, but especially to New South Wales and Queensland, where the sheep are nearly all merino, to ascertain the reason for this apparently unreasonable difference (for it is unreasonable, notwithstanding that the New Zealand and Australian mutton is frozen) in the price received by them for their mutton and that paid for the home article, and having ascertained what the reason really is, to see if something cannot be done to bring the price received for our mutton more on a level with that obtained for the Scotch and English.

In looking for this reason, I think the first question to settle is whether the mutton of our merino sheep, when they are killed in prime condition on or near their own pastures without deterioration or waste can be termed first-class; and there is no question that it can, for although it may not be quite so juicy, nor have the full flavour of the prime Scotch or Southdown mutton, it is much finer in the grain and sweeter than either of the home breeds mentioned, and when killed on or near the station where it is fattened it is equal to prime Welsh mutton. The fact of the excellent quality of the merino mutton, when obtained in prime condition and not wasted or deteriorated, is thoroughly well known to all who have been in the bush, and is only noticed here to emphasise the fact that the excessively low price which our merino mutton brings in London is not due to its being really an inferior article, but either because it is offered there in a deteriorated state, or because we do not receive fair value for it; and there is no doubt but both causes operate in a greater or less degree. I will therefore notice both, but the first very briefly, and will in the present paper deal principally with the second cause, as it affects the price obtained for merino mutton.

The complaint is made in regard to the New South Wales frozen mutton that it is dark in the colour, dry, and comparatively insipid. No doubt this is now true as regards a good deal of it through the ill-treatment and starvation to which under the existing live stock trade sheep are subjected, thereby causing deterioration in the appearance and flavour of our mutton. This calls loudly for a remedy, which it is believed has been found in the erection of up-country killing and chilling depôts, and the establishment of a fresh

meat trade, at which a commencement has been made, and there is every prospect that the movement in that direction will continue to increase until the trade is entirely changed. While, however, acknowledging that a good deal of the Australian merino mutton is not prime when offered in London, the greater part of it is of very fair quality and is put on the market in good condition, and would, it is believed, bring considerably more than it now does if better arrangements were made for its distribution and sale, and if it passed through fewer hands than it now does in reaching the consumers, with whom the producer of the mutton ought to be brought into closer contact. This again, it is thought, might be brought about by the formation of larger distributing companies, which would have cold stores in the great centres of the population through Great Britain, and which would obtain direct supplies of frozen meat from the freezing companies in this Colony and in Queensland.

Before, however, this can be brought about it will be necessary to assure these home-distributing companies that they will be able to obtain a constant supply of beef and mutton, and this assurance cannot be given until there is a considerable increase in this Colony and Queensland in the number of freezing works and in their daily output of frozen beef and mutton. When this takes place, and the freezing companies in the two colonies are in a position to guarantee a constant supply of frozen meat—and with such an extensive area and such large number of both cattle and sheep in the two colonies there ought not to be any trouble in keeping the home companies constantly supplied—it is believed that a thoroughly safe and remunerative meat-distributing business, conducted by firms or joint stock companies with the necessary capital, could be established in almost every one of the great centres of population in Great Britain and Ireland. To carry on such a business it would, of course, be necessary that extensive refrigerating stores should be erected, to which the frozen meat could be taken direct from the steamers and distributed with horses and carts every morning, and, if necessary, also in the afternoon, in the same way as milk is now delivered and paid for in all the large cities.

To enable these distributing companies again to enter upon and carry on their business successfully it would be necessary that the freezing companies in Australia should enter into an agreement to supply them with stated quantities of frozen beef and mutton—say, every fortnight or every month—for six or twelve months, at prices to be agreed upon between them, and, as has already been said, there would be little or no risk, with the two colonies to draw from, of the supply running short, even if a drought should occur in one part of Australia. That these distributing companies would pay there can, I think, be very little doubt, for they could, with about the same expense as that which the distribution of milk entails, deliver the meat which the same families require, while the gross cash returns for the meat would be many times greater than for the milk they use. And when it is considered that the expense of such a business would be very light compared with what the distribution of the same quantity of meat delivered from retail shops would be, it will be seen that such companies as are here suggested would pay well, and that the suggestion is very likely to be acted upon as soon as the colonies are able to guarantee constant supplies of first-class frozen beef and mutton, which, it is hoped, they will very soon be able to do.

It is scarcely necessary to point out that such an arrangement as that now sketched would, if practicable, be a very advantageous one for our sheep-owners, inasmuch as it would bring them and the consumers very much

more closely together than they now are, and would dispense with the middle man, the person who, it is said, now reaps the greatest benefit from the frozen meat trade, without doing much, if anything at all, for the toll he levies on the meat as it passes from the producer to the consumer. It has been proposed that our owners should go further than is here suggested, and distribute their meat from shops belonging to themselves in Great Britain. But the risk in adopting that course is too great, while it is believed that the suggestion here made would go a very long way in remedying the defects which now exist in the sale and distribution of our frozen meat, without incurring the risk which our retailing of the meat at home would inevitably entail, for the business with the distributing companies then would, so far as the Australian colonies are concerned, be a cash one, or what would be equal to cash on delivery in London.

XII. Why private enterprise has not in New South Wales taken up the Meat Export Trade as it has done in New Zealand.

From what has been said, it will be gathered, not only how the frozen meat trade was established in New Zealand, and how it has been conducted, but also that it has on the whole been very successful, and it will naturally be asked why the same course has not been followed in New South Wales; and the answer is that the circumstances in this Colony are very different and far less favourable for the development of private enterprise in the meat trade than New Zealand. Briefly stated, the difference in the circumstances of the frozen meat trade is the following:—

1. The climate of New Zealand is a comparatively steady and certain one. There they seldom or never suffer from droughts, as we, unfortunately, at times do, and when anything of that kind occurs in New Zealand it never does so with the same severity as it sometimes does in this Colony. In New Zealand, too, the rainfall is more evenly distributed throughout the year, and has a much more beneficial effect. That, of course, leads, where the land is good, to a steady, and in many places luxuriant, growth of rich pasturage, and that again brings a full and regular cast of fat stock, and not only stock-owners, but the people generally, having every confidence that the supply of fat stock would be maintained and increase, have been induced to invest their money in freezing companies, and have thus materially assisted in their establishment. With our uncertain climate the case is different, for there is considerable risk of the works being idle, perhaps for many months, and it is not to be expected that those who have no direct interest in stock would take shares in freezing companies with this uncertainty hanging over them.

2. The soil generally throughout New Zealand, with the exception of a portion of the North Island, is both very fertile and easily worked, and where there is any great depth of it—which there is in a great deal of the improved portions of the Colony—crops of all kinds are grown to an extent and in an abundance which would surprise our New South Wales pastoralists and farmers. This is especially noticeable in the splendid grain and root crops, as well as in the luxuriant and extensive fields of ryegrass and clover, with cocksfoot and other cultivated grasses intermixed, to be seen on all sides, from Taranaki and Gisborne in the North Island, to Invercargill and the Bluff in the south. When it is stated that the wheat crops in New

Zealand run from 20 to 50 bushels per acre, with an average of about 30 bushels, their turnip crops from 15 to 30 tons per acre, and that they carry and fatten from three to six and even eight sheep to the acre on their best grazing land, through the soil responding to the favourable rainfall, helped as it now is in many cases by manure, and worked under a systematic rotation, it will be evident to anyone who knows what our own Colony can do that the circumstances as regards the nature of the soil in a great deal of New Zealand are also different from those in the greater part of New South Wales, and that for these reasons also New Zealand is very much better able than this Colony to maintain a large and steady output of first-class fat sheep for the London market in proportion to the area of the Colony.

3. The New Zealand sheep again were, at the time the frozen meat export trade began, as they now are, in every way suited for the purpose. They were to a large extent crosses with the merino and the best English long-woolled breeds, and their crossbred wethers and maiden ewes were just the sort for the London market, for in appearance and quality the mutton so nearly resembled some of the best English as to enable the retail butcher (at first, at least, whatever they may do now) to sell the colonial mutton for English, thereby making a much greater profit than selling prime English, for which they had to pay at least one-third more money per stone. It need scarcely be said that our merino mutton could not be passed off for English, for both its size and colour would lead to any attempt of that sort being at once detected. Besides, the merino mutton is objected to on account of its small size. They say in England, "that there is not enough of cutting in a leg of merino mutton for an ordinary-sized family." The English people are accustomed to a good-sized leg of mutton, and they prefer what they are accustomed to. But it is hoped that when we can send them our merino mutton in prime condition without deterioration, and with all the goodness and sweetness in it, that they will, as we do, prefer the mutton of the smaller sheep.

4. Then, the proximity of the pastures in New Zealand to the seaboard, and the numerous shipping ports in that colony have given the owners there a very great advantage over ours in thus being able to ship the meat without the waste and deterioration going on in this Colony in conveying our sheep to a port of shipment, and this, too, has of course added to the other inducements to owners and others to form companies for export. The difference in this respect between the two colonies is most marked, and will have to continue until we can establish a chilled meat trade.

With a good climate, fertile soil, the right description of sheep, large tracts of improvable country, and pastoralists and farmers of the right stamp to turn these advantages to good account, as well as thoroughly reliable business men as directors, we cannot be surprised that persons in no way connected with stock, as well as those who were, invested their money in freezing companies in New Zealand, and as has already been said with good results; and in this fact lies one of the principal, if not the principal reason why that colony, with only 18,000,000 sheep, has now twenty-two freezing works, and in 1891 exported 2,000,000 of sheep, while our Colony, with some 60,000,000 of sheep, has only three freezing works, one of which has only a small capacity, with a fourth being constructed, and the export to our credit of frozen sheep during that year was less than half a million. With our uncertain climate, little or no land laid down in cultivated grasses, comparatively few crossbred sheep, an excessive proportion of breeding sheep, very few wethers suitable for freezing, and long distances to bring fat sheep to the seaboard, there has been no inducement to persons other

than stock-owners to invest their money in meat-freezing works, especially as our merino mutton has been bringing low prices in the London market, and of course the same reasons have (although they should not have done so) deterred sheep-owners themselves forming freezing and export companies.

XIII. What should now be done in this Colony.

As, therefore, our stock-owners must depend entirely upon themselves in establishing a paying meat export trade of sufficient volume to deal with the whole of our surplus sheep in a satisfactory manner, they should, if they do not mean to let things drift and allow the entire frozen meat export trade of the Colony to remain under the control of one or two firms, take the matter up and deal with it in a thorough and businesslike manner; for it is only by systematic organisation on their part, and by making proper arrangements for the economic utilisation and distribution of the meat they produce, that they can make their calling a success. To effect this again considerable capital will be required, and to raise that there must be extensive combination and hearty co-operation on their part as a class before a paying export business can be established. This being the case, the question arises how this combination and co-operation should be brought about—whether (1) by owners voluntarily forming joint stock companies for killing, chilling, freezing, and exporting meat, or (2) by legislating, as was proposed by the Bill introduced last Session of Parliament, for promoting the establishment of an export trade in meat, by assisting in the erection of chilling and freezing works, and in other ways.

Bearing in mind the very great difference in the circumstances of this Colony and New Zealand, I think it is to be regretted that the Bill did not pass, as it has been shown that if an export trade is to be established it will have to be so by owners themselves, and they will require to take the risk there may be in doing so for the indirect advantages they will receive through its establishment. This being the case, there could not possibly have been a more liberal, equitable, or effective mode of meeting the difficulty, nor one which is more generally approved by those interested, than that contemplated by the Bill. This is confirmed by the fact that a majority of more than two to one of the owners who it was proposed by the Bill should be rated (those with less than 2,000 sheep were to get all the benefit without contributing) have declared in favour of the Bill.

It is submitted, therefore, that notwithstanding what has been said by some of the promoters of the Bill against taking further action in regard to it, the question of its re-introduction is well worth considering, seeing that there has been really nothing, or next to nothing, done by private enterprise towards the establishment of this trade since the Bill was introduced. No doubt the number of owners who stated, in reply to circulars issued by the Murrurundi Board, "that they were not in favour of the Bill," is greater than the returns of the Pastures Boards would have led the promoters of the Bill to suppose it would be; and there is reason to believe that the "boom" in the formation of chilling and freezing meat companies which took place some six or eight months ago, and which, after all, came to nothing, led a great many of these owners to reply as they did. But although they in several instances assigned as their reason for replying in the negative, that "the matter should be left to private enterprise," it would not seem that either these owners, or those who have not replied to the circular, are prepared to assist in the formation of a company or companies for the

construction of chilling and freezing works, otherwise they would have let the fact be known, and asked their fellow-owners to co-operate with them in the undertaking.

However this may be, except in the case of the killing and chilling depôts at Tenterfield, Narrandera, and Young, which were either erected or projected when the Bill referred to was introduced, our stock-owners have done nothing towards putting our meat trade on a proper footing, and if this most important matter is not to be allowed to drift, as it has been doing, and glutted markets and ruinously low prices to continue—either this Bill will have to be reintroduced and carried through, or our stock-owners will have to form strong companies, which will, without further delay, deal with the whole trade in a practical and business-like way by establishing killing and chilling works throughout the Colony, and at the same time making sufficient provision for freezing the surplus meat at the port of shipment.

I hope to be able, in the course of next week, to prepare a short report on stock and stock-raising and fattening in New Zealand—subjects which are closely connected with those dealt with in this paper, and to show that the system of farming and growing of root and green crops and cultivated grasses, and the breeding and fattening of long-woolled sheep, which have been so successfully carried out in New Zealand, can also be adopted in the colder and more temperate portions of this Colony.

The Action of Acid Fumes on Vegetation.

In consequence of a communication received in the Department from Meadow Flat, expressing a belief that the fumes from smelting works at Sunny Corner, were causing destruction to the vegetation, the following reports have been made. The first is by Mr. F. B. Guthrie, analytical chemist, to the Department, dealing generally with the action of acid fumes in vegetation; while the second is by Mr. A. H. Benson the fruit expert who visited Meadow Flat.

Mr. Guthrie says, "There is no doubt that the neighbourhood of smelting or similar works where acid vapours are evolved is exceedingly injurious to vegetation, though the extent of the injury is not always easy to determine. The most injurious ingredient is sulphurous acid, the gas formed by burning sulphur. Vegetation appears to be injured by this gas in the following order: meadow grass, fruit-trees, cereals, potatoes, turnips, &c., grass being most liable to injury, turnips least.

The damage done is described differently by different observers. The plants of a root crop grown in the vicinity of a cellulose factory were found to have been completely charred, the injury in this case being due to sulphuric acid. In the neighbourhood of blende smelting works, it has been observed that grain crops grow thin, the ears small, stalks weak, and potato leaves wrinkled and covered with black spots. The ash of these sickly plants has been found to contain more sulphates than that of the same plants grown at a greater distance. The leaves of trees exposed to this smoke also contains more sulphuric and less carbonic acid than those of uninjured trees. In the case of straw injured by the same cause, 17 per cent. more sulphates were present in the ash than in the case of healthy straw. At the same time the amount of sulphuric acid present does not furnish a safe guide, as this ingredient differs in healthy plants of the same kind, and it has not frequently been found that the injured plants contained less than uninjured ones.

Young meadow herbage was found to be most susceptible to the influence of smoke from blende works, oats resisting its action better than wheat, while potatoes were even able to thrive on it.

At a meeting of scientists in Cologne, where this subject was under discussion, the conclusion arrived at was that the principal damage was due to sulphurous acid gas from the coal used for fuel. Besides the direct action of sulphurous acid on the plants it undoubtedly acts prejudicially on the air. It has been found, for instance, that the ozone in the air near towns has been destroyed by this gas.

A mass of evidence was given before a Royal Commission appointed in England in 1878, to inquire into noxious vapours. From the account of various witnesses it appeared that the sulphurous acid from coal smoke was particularly injurious, grass, trees, cereals, potatoes suffer in the order

named; turnips appeared to be the least affected, cattle suffer when fed upon the injured crops. The radius of the affected area appears to be about $1\frac{1}{2}$ miles, though this would be greatly influenced by other conditions, the strength and the direction of the prevailing winds, and position, sheltered or otherwise, of the crops.

One of the results of the Commission, was the recommendation that the presence of 1 grain of sulphur (in the form of any of its compounds) in 1 cubic foot of the exit gases from chemical works, &c., be an offence under the Act, and, I believe, that in England that limit has been fixed by law.

As to the action of arsenic, its injurious effect appears to be confined to the roots; where the leaves alone are exposed the action is very slow. It is, however, exceedingly poisonous when applied to the roots, one part of arsenic in a million parts being sufficient to wither a plant. It appears to act on the protoplasm of the root, hindering osmose and consequently absorption of food.

It is very difficult to estimate the extent of the damage done, or even to be quite certain that it is really due to acid fumes. The external appearance of plants injured in this way is very similar to plants injured by disease, bad drainage, or insufficient nourishment. Neither does the chemical analysis of the plant afford any reliable proof, for the reasons I have stated above.

It is necessary, therefore, to eliminate all other possible causes of injury, such as the above-mentioned, presence of insects, &c. It is to be noted that healthy plants withstand the action of noxious vapours far better than weak or ill-nourished ones. It is well to consult Dr. Angus Smith's book on "Air and Rain," at the end of which is a table, "the Scale of Injury," which gives the order in which different forms of vegetation suffer. If, for instance, potatoes are found to suffer more than grass, the injury could not be attributed to smelting works.

The orchard in question is so far from the works that I should be inclined to doubt whether the fumes would cause any permanent injury."

Mr. Benson reported, as the result of his visit to the orchard on the 2nd December last, that "the action of the fumes would not be likely to do damage at Meadow Flat, as it is at least 6 miles away from the works. The apples are badly affected with scab (*Fusicladium dendriticum*), and it is the effect of this fungus disease that has been put down to acid fumes. The pears are affected with *Fusicladium pyrinum*, and cherries with *Monilia frutigena*, destroying the foliage."

Comparison of American and Australian Maize

By F. B. GUTHRIE,
Departmental Analyst.

A SAMPLE of the ground pith of maize-cob was forwarded to the Department for analysis by the Principal of the Hawkesbury Agricultural College. The following numbers give the percentage composition of the sample:—

Corn-cob Meal.	
Water	13·575
Fat	·595
Fibre	35·311
Albuminoids	4·451
Carbo-hydrates	44·471
Ash	1·597
	100·

Ash.	
Silica	20·476
Lime	·817
Phosphoric acid	4·859
Magnesia	1·753
Potash	24·360

The above was a somewhat coarsely ground meal. The feeding value is fair, being about 50. The ratio between albuminoids and carbo-hydrates being 1 to 10½.

Compared with maize-meal it does not contrast so unfavourably as one would at first expect. The feeding value is rather more than half that of maize, the principal difference being the high proportion of insoluble and practically indigestible fibre present in the cob, and the diminution in the digestible constituents, the fat having almost disappeared. The following is the average composition of maize meal.

Water	14·2
Fat	5·0
Albuminoids	9·3
Starch, &c.	66·5
Cellulose	3·0
Ash	2·0
	100·

A comparison of these analyses shows at once the difference in the two products.

The starch in the maize-meal has, to a large extent, vanished in the cob. Its place, however, is taken by a soluble form of cellulose (which is also abundantly present in grass), and to which is assigned a feeding value somewhat lower than starch. The full significance of its value is not at present properly understood, but it probably has a value little less than that of starch. There is also no doubt that the fibre present in cob-meal, though practically indigested by the animal, and of no value as food, has nevertheless a distinct value in mechanically promoting digestion. There is, therefore, some difficulty in assigning its feeding value to cob-meal.

Its true value can only be determined by a series of experiments in feeding cattle upon it, with a view to determining its digestive and assimilative power upon different animals.

The addition of maize would, of course, greatly increase its feeding value. Suppose a mixture were made of one-half corn-meal and one-half cob-meal, its composition would be approximately the following :—

Water ...	13·9
Oil	2·8
Fibre ...	19·55
Albuminoids ...	6·85
Carbo-hydrates	55·5
Ash	1·8
	100·00

The nutrient value of such a mixture would be 70; the ratio between albuminoids and carbo-hydrates, 1 to 9·2.

It will be interesting to compare other analyses of this product with that of the sample under discussion. I have only been able to find three other analyses, all from America—two from the Department of Agriculture, Washington, by Messrs. Collier and Wiley respectively, and the third by Mr. Schweitzer, of the Missouri Agricultural College.

For the sake of comparison these are all calculated to dry substance in the accompanying table:—

Analyses of Corn-cobs.

	Missouri—Mr. Schweitzer.	Washington. I Mr. Collier.	Washington. II Mr. Wiley.	Department
Oil...	1·07	0·84	0·52	0·68
Fibre	34·27	42·18	33·48	40·85
Albuminoids	3·06	2·72	2·76	5·16
Carbo-hydrates ...	60·11	52·95	61·77	51·46
Ash	1·49	1·31	1·47	1·85

The most striking feature in the above numbers is the large percentage of nitrogen albumen in the Australian product—at least, in the sample analysed.

Mr. Schweitzer also gives an analysis of the ash, which is subjoined for the sake of comparison :—

	Missouri.	Department.
Silica ...	24·98	20·476
Ferric oxide ...	·19	......
Phosphoric acid	2·82	4·859
Lime ...	1·77	·817
Magnesia	5·45	......
Potash ...	51·16	24·360
Soda ...	0·8	......

There is here a strongly marked deficiency in potash in our product, which is very remarkable. This discrepancy in the ash becomes, however, a very small one when the numbers are calculated to the whole meal—not more than about 0·3 per cent.

The manurial value of the cob-meal is small, the following being the percentages for the chief manurial ingredients, calculated upon the whole substance—about 12s. per ton when ground up.

Potash ...	·389 per cent.
Phosphoric acid ...	·077 ,,
Nitrogen ...	·712 ,,

The value of the manure resulting from its use as food could only be determined by analysis.

Analyses of Soils.

By F. B. GUTHRIE,
Departmental Analyst.
(With notes by the Director of Agriculture).

Tambar Springs.

A sample of soil from Tambar Springs has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is loam; the reaction of the soil is neutral; and its capacity for water, 51 per cent. Absolute weight per acre, 6 inches deep, 2,489,758 lb.

A mechanical analyses of this soil shows that it contains of root fibres, ·06 per cent.; stones over $\frac{1}{4}$-inch in diameter, ·0 per cent.; coarse gravel, more than $\frac{1}{10}$-inch diameter, 2·5 per cent.; fine gravel, more than $\frac{1}{50}$-inch diameter, 1·25 per cent.; fine soil, 96·19 per cent., comprising sand, 38·45 per cent., and impalpable matter, chiefly clay, 57·74 per cent.

An analysis of the fine soil discloses moisture, 9·595 per cent., and volatile and combustible matter, principally organic, 5·553 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), 3·086 per cent., the general value of which is excellent, being equivalent to 61,720 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·235 per cent., the general value of which is good, being equivalent to 4,700 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·092 per cent., the general value of which is satisfactory, being equivalent to 1,840 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·089 per cent. (equal to ·109 per cent. of ammonia), the general value of which is satisfactory, being equivalent to 1,780 lb. (*d*) in an acre of soil 6 inches deep. There is also magnesia (MgO), ·776 per cent., general value of which is very good; ferric oxide (Fe_2O_3), 4·155 per cent.; general value satisfactory; and sulphuric acid (SO_3), ·069 per cent.; general value, fair; ferrous oxide, ·615 per cent.

In connection with the foregoing particulars, the special points of value in the soil are lime and potash, and there are no special defects. Its general character mechanically is good, and chemically very good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are vines, lucerne, potatoes (if enough rain), while it is unsuitable, without special manure or special treatment, for none suited to the climate. The manures and treatment

Note.—(*a*) This amount of lime would be supplied in 68,577 lb. of quicklime, or 90,617 lb. of slaked lime, or 122,458 lb. of chalk. (*b*) This amount of potash would be supplied in 9,400 lb. of commercial sulphate of potash, or 39,166 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 7,360 lb. of commercial bone-dust, or 11,040 lb. of superphosphate. (*a*) This amount of nitrogen would be supplied in 8,900 lb. of sulphate of ammonia, or 10,680 lb. of nitrate of soda.

recommended for trial are, as the phosphoric acid and nitrogenous matter are the valuable manurial constituents that will fail first, a dressing of 2 cwt. per acre of dried blood and bone-dust or Sugar Company's No. 2 (superphosphate and sulphate of ammonia) may be found to pay well.

Speaking generally, the soil ought to grow for some years good crops of anything suited to the climate. Judicious working to let the oxygen and carbonic acid gas of the air exert their beneficial influence, will benefit the soil very much.

Raymond Terrace.

A sample of soil from Raymond Terrace has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is light sandy loam; the reaction of the soil is neutral; and its capacity for water, 27·66 per cent. Absolute weight per acre, 6 inches deep, 3,248,931 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·08 per cent.; stones over ¼ inch in diameter, ·41 per cent.; coarse gravel, more than $\frac{1}{10}$ inch diameter, 1·35 per cent.; fine gravel, more than $\frac{1}{40}$ inch diameter, 13·33 per cent.; fine soil, 84·83 per cent., comprising sand, 66·64 per cent., and impalpable matter, chiefly clay, 18·19 per cent.

An analysis of the fine soil discloses moisture 1·452 per cent., and volatile and combustible matters, principally organic, 3·301 per cent.

The fertilizing substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·228 per cent., the general value of which is good, being equivalent to 6,840 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·336 per cent., the general value of which is good, being equivalent to 10,080 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·068 per cent., the general value of which is fair, being equivalent to 2,040 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·117 per cent. (equal to ·142 per cent. of ammonia), the general value of which is satisfactory, being equivalent to 3,510 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·083 per cent., general value of which is fair; ferric oxide (Fe_2O_3), ·651 per cent., general value deficient; and sulphuric acid (SO_3), ·047 per cent., general value, satisfactory; ferrous oxide, ·216 per cent.

In connection with the foregoing particulars, the special point of value in the soil is its mechanical condition; its special defect, phosphoric acid; its general character mechanically is very good, and chemically fair. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are vegetables, fruit trees, roots; while it is unsuitable, without special manure or special treatment, for grain crops. The manures and treatment recommended for trial are: good bone-dust, 4 to 6 cwt. per acre, or Sugar Company's No. 2 manure. If for green crops, broadcast it; if for vegetables, sow in the drills, mixing well with the soil.

Speaking generally, first a good dressing of lime, 1 ton per acre, lightly harrowed in during autumn is recommended. This will decompose any

Note.—(*a*) This amount of lime would be supplied in 5,066 lb. of quicklime, or 6,694 lb. of slaked lime, or 9,047 lb. of chalk. (*b*) This amount of potash would be supplied in 20,160 lb. of commercial sulphate of potash, or 84,000 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 8,160 lb. of commercial bone dust, or 12,240 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 17,550 lb. of sulphate of ammonia, or 21,060 lb. of nitrate of soda.

clay and vegetable matter in the soil. Then at end of winter, or before crop is put in, 4 to 6 cwt. of good bone-dust, or bone-dust and blood, which should be buried lightly. In the second year Sugar Company's No. 2, 4 cwt. per acre in the spring.

CHATSWORTH.

A SAMPLE of soil from Chatsworth, Clarence River, has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is loam; the reaction of the soil is neutral; and its capacity for water 57 per cent. Absolute weight per acre, 6 inches deep, 2,367,311 lb.

A mechanical analysis of this soil shows that it contains of root fibres ⅛ per cent.; stones over ¼ inch in diameter, ·0 per cent.; coarse gravel, more than $\frac{1}{10}$ inch diameter, ·0 per cent.; fine gravel, more than $\frac{1}{40}$ inch diameter, ·0 per cent.; fine soil, 99·86 per cent., comprising sand, 47·08 per cent., and impalpable matter, chiefly clay, 52·78 per cent.

An analysis of the fine soil discloses moisture, 3·353 per cent., and volatile and combustible matter, principally organic, 6·675 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·369 per cent., the general value of which is good, being equivalent to 8,610 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·226 per cent, the general value of which is good, being equivalent to 5,273 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·152 per cent., the general value of which is good, being equivalent to 3,547 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·151 per cent. (equal to ·183 per cent. of ammonia), the general value of which is good, being equivalent to 3,523 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·211 per cent., general value of which is good; ferric oxide (Fe_2O_3), 3·338 per cent., general value satisfactory; and sulphuric acid (SO_3), ·075 per cent., general value, fair; ferrous oxide, ·671 per cent.

In connection with the foregoing particulars, the special points of value in the soil are potash and phosphoric acid; its special defects, none. Its general character mechanically is good, and chemically, good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are maize, sugar-cane, grass; while it is unsuitable, without special manure or special treatment, for none suited to the climate, if properly treated. The manures and treatment recommended for trial are lime (1 ton per acre) the first autumn; Sugar Company's. No. 2 manure, 4 cwt. per acre, in spring; filter press muck is not complete enough in itself to suit this soil, but should be composted with twice its weight of lime before being applied to the soil.

Speaking generally, the lime will break up the clay, mellow the soil, liberate the latent and insoluble potash of the clay, and decompose the organic matter in the soil. The Sugar Company's manure in spring will supplement this and nourish very heavy crops of maize or cane. Land should be left fallow or in furrows as much as possible, without being levelled down, in order to let air exert its beneficial influence.

NOTE.—(*a*) This amount of lime would be supplied in 8,200 lb. of quicklime, or 10,835 lb. of slaked lime, or 14,642 lb. of chalk. (*b*) This amount of potash would be supplied in 10,546 lb. of commercial sulphate of potash, or 43,942 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 14,188 lb. of commercial bone-dust, or 21,282 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 15,100 lb. of sulphate of ammonia, or 18,120 lb. of nitrate of soda.

BATHURST.

No. 1. Light Granitic Soil.

A SAMPLE of soil from Bathurst Experimental Farm has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is light sandy loam; the reaction of the soil is neutral; and its capacity for water 26 per cent. Absolute weight per acre, 6 inches deep, 3,061,179 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ½ per cent,; stones over ½-inch in diameter, ·0 per cent.; coarse gravel, more than 1/10-inch diameter, ·52 per cent.; fine gravel, more than 1/50-inch diameter, 19·46 per cent.; fine soil, 79·90 per cent., comprising sand, 60·68 per cent., and impalpable matter, chiefly clay, 19·22 per cent.

An analysis of the fine soil discloses moisture, ·887 per cent., and volatile and combustible matter, principally organic, 1·396 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·170 per cent., the general value of which is satisfactory, being equivalent to 5,100 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·095 per cent, the general value of which is satisfactory, being equivalent to 2,850 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·039 per cent., the general value of which is indifferent, being equivalent to 1,170 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·061 per cent. (equal to ·074 per cent. of ammonia), the general value of which is fair, being equivalent to 1,830 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·095 per cent., general value of which is fair; ferric oxide (Fe_2O_3), ·855 per cent., general value deficient; and sulphuric acid (SO_3), ·048 per cent., general value indifferent; ferrous oxide, ·252 per cent.

In connection with the foregoing particulars, the special point of value in the soil is its good mechanical condition; its special defects, phosphoric acid, organic (nitrogenous) matter, and low power of retaining moisture. Its general character mechanically is good, and chemically, tolerable. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are potatoes and fruit trees; while it is unsuitable, without special manure or special treatment, for grain crops, green stuff, or good grass. The manures and treatment recommended for trial are Sugar Company's No. 2 manure (2 to 4 cwt. per acre); Gee's bone-dust and dried blood (2 to 4 cwt. per acre); farmyard manure, enriched with 2 cwt. of bone-dust per ton; ploughing in peas or vetches. If this soil will not pay for manuring it will hardly pay for wheat-growing without manure after the first few years.

Speaking generally, treating the soil with these manures should give good results for a few years, after which potash also will be needed. Lime (1 ton per acre) will liberate this from the granitic sand in the soil at the least possible cost. It will be a calamity to crop this soil, and get it into bad heart in very few years, instead of feeding it fairly from the start, and thus keeping on improving it.

NOTE.—(*a*) This amount of lime would be supplied in 5,665 lb. of quicklime, or 7,486 lb. of slaked lime, or 10,118 lb. of chalk. (*b*) This amount of potash would be supplied in 5,700 lb. of commercial sulphate of potash, or 23,750 lb of kainit. (*c*) This amount of phosphoric acid would be supplied in 4,680 lb. of commercial bone-dust, or 7,020 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 9,150 lb. of sulphate of ammonia, or 10,980 lb. of nitrate of soda.

No. 2. Dark Alluvial Soil.

A SAMPLE of soil from Bathurst Experimental Farm has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is clay loam; the reaction of the soil is neutral; and its capacity for water, 64·33 per cent. Absolute weight per acre, 6 inches deep, 1,938,746 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·22 per cent.; stones over $\frac{1}{4}$ inch in diameter, ·0 per cent.; coarse gravel, more than $\frac{1}{10}$ inch diameter, ·0 per cent.; fine gravel, more than $\frac{1}{30}$ inch diameter, ·41 per cent.; fine soil, 99·37 per cent., comprising sand, 28·81 per cent., and impalpable matter, chiefly clay, 70·56 per cent.

An analysis of the fine soil discloses moisture, 4·891 per cent., and volatile and combustible matter, principally organic, 8·275 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·431 per cent., the general value of which is good, being equivalent to 8,620 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·181 per cent., the general value of which is good, being equivalent to 3,620 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·135 per cent., the general value of which is satisfactory, being equivalent to 2,700 lb. (*c*) in an acre of soil 6 inches deep, nitrogen, ·241 per cent. (equal to ·292 per cent of ammonia), the general value of which is good, being equivalent to 4,820 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·289 per cent., general value of which is good; ferric oxide (Fe_2O_3), ·864 per cent., general value deficient; and sulphuric acid (SO_3), ·044 per cent., general value indifferent; ferrous oxide 1·008 per cent.

In connection with the foregoing particulars, the special points of value in the soil are phosphoric acid and organic (nitrogenous) matter, capacity for retaining moisture; its special defects, stiff character for working, presence of ferrous oxide, which can easily be got rid of; its general character mechanically is very fair, and chemically good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are any suited to the climate; while it is unsuitable, without special manure or special treatment, for root crops, for which it is rather stiff. The only treatment needed at present is good cultivation. The atmosphere will sweeten the soil and turn the lower black oxide of iron into the red oxide (rust); it will also decompose the insoluble manurial constituents making them soluble and therefore available for plant food. Speaking generally, if this soil is not fallowed before cultivation, the addition of 1 ton of lime per acre will greatly improve it. This dressing will also be very beneficial for grass or any crop which does not allow of regular cultivation.

SPRINGWOOD.

A SAMPLE of soil from Springwood has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is clay loam; the reaction of the soil is neutral; and its

NOTE.—(*a*) This amount of lime would be supplied in 9,577 lb. of quicklime, or 12,655 lb. of slaked lime, or 17,102 lb. of chalk. (*b*) This amount of potash would be supplied in 7,240 lb. of commercial sulphate of potash, or 30,166 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 10,800 lb. of commercial bone-dust, or 16,200 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 24,100 lb. of sulphate of ammonia, or 28,920 lb. of nitrate of soda.

capacity for water, 53·33 per cent. Absolute weight per acre, 6 inches deep, 2,117,314 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·33 per cent.; stones over ¼ inch in diameter, 2·70 per cent.; coarse gravel, more than $\frac{1}{10}$ inch in diameter, 8·81 per cent.; fine gravel, more than $\frac{1}{40}$ inch diameter, 8·02 per cent.; fine soil, 80·14 per cent., comprising sand, 14·72 per cent., and impalpable matter, chiefly clay, 65·42 per cent.

An analysis of the fine soil discloses moisture, 3·127 per cent., and volatile and combustible matter, principally organic, 10·199 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·156 per cent., the general value of which is satisfactory, being equivalent to 3,120 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·108 per cent., the general value of which is satisfactory, being equivalent to 2,160 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·070 per cent., the general value of which is fair, being equivalent to 1,400 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·280 per cent. (equal to ·340 per cent. of ammonia), the general value of which is good, being equivalent to 5,600 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·120 per cent. general value of which is satisfactory; ferric oxide (Fe_2O_3), 2·279 per cent.; sulphuric acid (SO_3), ·059 per cent., general value, fair; ferrous oxide, ·792 per cent.

In connection with the foregoing particulars, the special points of value in the soil are nil; its special defect, phosphoric acid; its general character mechanically is tolerable and chemically fair. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are summer fruit, hay, and beans, while it is unsuitable, without special manure or special treatment, for grain, citrus fruit, and roots. The manures and treatment recommended for trial are—Dressing of lime, 1 ton per acre in autumn, with 2 to 4 cwt. per acre of dried blood and bone-dust in winter, or the same weight of Sugar Company's manure in spring.

Speaking generally, working and opening to the air will improve this soil very much. Drainage ought to make it suitable for all classes of fruit trees.

BULLAHDELAH.

A SAMPLE of soil from Bullahdelah has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is clay loam; the reaction of the soil is neutral; and its capacity for water, 48·7 per cent. Absolute weight per acre, 6 inches deep, 2,165,273 lb.

A mechanical analysis of this soil shows that it contains of root fibres, 18 per cent.; stones over ¼ inch in diameter, ·0 per cent.; coarse gravel, more than $\frac{1}{10}$ inch diameter, ·58 per cent.; fine gravel, more than $\frac{1}{40}$ inch diameter, 1·35 per cent.; fine soil, 97·89 per cent., comprising sand, 30·12 per cent., and impalpable matter, chiefly clay, 67·77 per cent.

NOTE.—(*a*) This amount of lime would be supplied in 3,466 lb. of quicklime, or 4,580 lb. of slaked lime, or 6,190 lb. of chalk. (*b*) This amount of potash would be supplied in 4,320 lb. of commercial sulphate of potash, or 18,000 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 5,600 lb. of commercial bone-dust, or 8,400 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 28,000 lb. of sulphate of ammonia, or 33,600 lb. of nitrate of soda.

An analysis of the fine soil discloses moisture, 2·584 per cent., and volatile and combustible matter, principally organic, 2·865 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·135 per cent., the general value of which is satisfactory, being equivalent to 2,700 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·289 per cent., the general value of which is good, being equivalent to 5,780 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·054 per cent., the general value of which is fair, being equivalent to 1,080 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·084 per cent. (equal to ·102 per cent. of ammonia), the general value of which is satisfactory, being equivalent to 1,680 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·085, general value of which is fair; ferric oxide (Fe_2O_3), ·730 per cent., general value deficient; and sulphuric acid (SO_3), ·044 per cent., general value indifferent. Ferrous oxide, ·072 per cent. Contains also ·137 per cent. soluble alumina, equivalent to ·459 per cent. of sulphate of alumina, which, if present as potash-alum, would represent 1·273 per cent. This amount is not likely to prove injurious, if deep cultivation and fallowing a few months before sowing are practised.

In connection with the foregoing particulars, the special points of value in the soil are nil; its special defects, phosphoric acid and nitrogenous matter; its general character mechanically is fair but rather stiff for seed crops, and chemically fair. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are beans, peas, summer fruit, while it is unsuitable, without special manure or special treatment, for grain, hay, or good grasses. The manures and treatment recommended for trial are liming, 1 ton per acre; bone-dust and dried blood, such as Gee's fertiliser, 2 to 4 cwt. per acre for grass, maize, oats, and vegetables.

Speaking generally, the lime will burst up and mellow the clay, liberating the latent supplies of potash which is at present insoluble; it will also help to neutralise any ill effects of the alum present. Whether it will pay to treat the soil and manure it as indicated, is a matter for local experience. The soil is not likely to do much good for a long period without such treatment.

Port Macquarie.

A sample of soil from Telegraph Point, Port Macquarie, has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The geological formation of the surrounding county is sandstone; the nature of the soil is loam; the reaction of the soil is neutral; and its capacity for water, 48 per cent. Absolute weight per acre, 6 inches deep, 2,373,434 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·06 per cent.; stones over $\frac{1}{4}$ inch in diameter, ·0 per cent.; coarse gravel, more than $\frac{1}{10}$ inch diameter, 1·14 per cent.; fine gravel, more than, $\frac{1}{50}$ inch diameter, 2·56 per cent.; fine soil, 96·24 per cent., comprising sand, 43·68 per cent., and impalpable matter, chiefly clay, 52·56 per cent.

Note.—(*a*) This amount of lime would be supplied in 3,000 lb. of quicklime, or 3,964 lb. of slaked lime, or 5,357 lb. of chalk. (*b*) This amount of potash would be supplied in 11,560 lb. of commercial sulphate of potash, or 48,167 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 4,320 lb. of commercial bone-dust, or 6,480 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 8,400 lb. of sulphate of ammonia, or 10,080 lb. of nitrate of soda.

An analysis of the fine soil discloses moisture, 2·164 per cent., and volatile and combustible matter, principally organic, 6·377 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consists of: Lime (CaO), ·163 per cent., the general value of which is satisfactory, being equivalent to 3,803 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·066 per cent., the general value of which is fair, being equivalent to 1,540 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·032 per cent., the general value of which is indifferent, being equivalent to 747 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·151 per cent. (equal to ·183 per cent. of ammonia), the general value of which is good, being equivalent to 3,523 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·035 per cent., general value of which is bad; ferric oxide (Fe_2O_3), 1·063 per cent., general value deficient; sulphuric acid (SO_3), ·062 per cent., general value fair; ferrous oxide, ·720 per cent.

In connection with the foregoing particulars, the special points of value in the soil are none; its special defect, phosphoric acid; its general character mechanically is fair, and chemically moderately good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are green feed, summer fruit; while it is unsuitable, without special manure or special treatment, for cereals, roots, or citrus fruit. The manures and treatment recommended for trial are any complete manure, such as fowl dung or stable manure, Gee's complete fertilizer, 4 to 6 cwt. per acre, or Sugar Company's No. 3 manure, 4 cwt. per acre. Lime ½ ton per acre in autumn, would benefit the soil very much, breaking up the clay and liberating the potash.

Speaking generally, the manure most required is some form of phosphoric acid, whether bone-dust or superphosphate; the former should be applied in the autumn, the latter when the seed is sown or in the spring.

NOTE.—(*a*) This amount of lime would be supplied in 4,226 lb. of quicklime, or 5,584 lb. of slaked lime, or 7,546 lb. chalk. (*b*) This amount of potash would be supplied in 3,080 lb. of commercial sulphate of potash, 12,833 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 2,988 lb. of commercial bone-dust, or 4,482 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 17,615 lb. of sulphate of ammonia, or 21,138 lb. of nitrate of soda.

Poultry.

By The Sub-Editor.

Soft Foods.

Having in a previous issue dealt shortly with the varieties and method of feeding grain to poultry, a few hints with regard to soft food may possibly come as news even to farmers who have had a "few hens about the place" for years. It will doubtless be admitted that any method of utilising waste must of necessity effect economy, and therefore any otherwise waste matter which can be beneficially used, instead of purchasing fresh material, would naturally ensure a better return in selling the product. In no instance is this better exemplified than in feeding poultry for the market, and it is astonishing the quantity of waste on a farm which may be beneficially fed to poultry.

The writer is personally strongly in favour of feeding a soft meal every morning all the year round. These meals admit of infinite variety, and can be fed warm in the cold weather and cold in summer. A very good plan is to keep a sort of stock-pot, in which may be thrown all kitchen scraps, bones, meat, surplus cooked vegetables, puddings, &c. To this may be added thoroughly cooked waste portions of vegetables, i.e., the outside leaves of cabbages, turnip and carrot tops, potato parings—in fact, any fresh edible vegetable matter. As may be supposed, this "mess" is of too soupy a character to feed as it comes from the copper. This very soupiness is one of the greatest drawbacks in feeding soft foods, and is the cause of many complaints to which fowls are liable. In order to avoid this, a portion should be taken out in a sieve or colander, so that the surplus moisture may run off. When this has been accomplished it may be either fed alone as a separate meal, or placed in a tin dish and gradually mixed with pollard, until it becomes sufficiently dry to crumble to pieces when dropped on the ground, and then be used for the early morning meal. This is the proper state in which to give soft food to fowls, and the best plan, both to avoid waste and insure cleanliness, is to distribute the mess in the rough iron troughs described in last month's issue. It is very essential that the stock pot, or rather its contents, should always be sweet. It is a great mistake to suppose that fowls thrive on anything. By some miraculous means fowls do occasionally pull through on all sorts of filth, but should they contract disease under such circumstances nothing will save them.

Advantage should be taken of this soft meal to give any general medicine that may be required. Thus, during the moulting season, a small quantity of powdered sulphur may be given with advantage two or three times a week, and (say) once a week, some of the sulphate of iron tonic.

Whether soft food be fed hot or cold, it should always be mixed with boiling water, and during the hot weather the simplest way is to mix up sufficient over night, in order that it may be ready to feed cold in the

morning. Should no table scraps and vegetables be available, a mess may be made of two parts bran and one part pollard, mixed "short" with boiling water, and fed warm or cold, according to circumstances.

There are, of course, other and more expensive poultry foods which are useful, and even necessary under certain circumstances. In breeding for show purposes, and for young, well-bred chickens, some of the patent foods are almost essential if success would be achieved. Probably the best of these is that manufactured by Spratt and Co., and known as "Spratt's Poultry Meal," now obtainable in Sydney. The mixture recommended by Lewis Wright, is equal parts of half-ground oats or coarse oatmeal and Spratt's meal.

With regard to quantity, there cannot be any hard and fast rule laid down. There should be a sufficient number of troughs to permit of all the fowls "getting their heads in," and the proper rule is to remove the surplus food and wash out the troughs as soon as the birds cease to eat with avidity and begin to pick the food over.

There are many little additions to the soft food which find favour with different breeders. Thus in the cold weather some add a little red pepper or a few peppercorns. The writer has a predilection in favour of curry powder, and the curry which is left over from the table is invariably saved for the fowls and is eaten with evident relish. Any poultry-keeper who takes an interest in his stock will naturally find out what his birds take with a relish and note it for use when he wants to give them a "fillip."

Having dealt with soft foods, more particularly as applied to adult fowls, a few words on the feeding of young chicks are necessary to make the subject more complete. There is no doubt that bread soaked in milk and well squeezed is the best food to give after the first twenty-four hours, for the first two or three days. This may be followed by chopped egg and breadcrumbs, varied with a mixture of two-thirds oatmeal to one-third barley meal, and a daily meal of Spratt's "crissel," to supply the place of insect food so necessary for gallinaceous birds. In every instance the rule regarding a moderate amount of moisture must be strictly adhered to.

It is not for one moment assumed that the whole subject of soft foods has been dealt with in this article. The information given in these columns is intended to cover the main features of the subject considered, and to be suggestive in character. A hint is sufficient for anyone who really takes an interest in any subject, and in many cases petty detail becomes irksome. Then again the desire is also to arouse an interest where none at present exists, and in such cases detail is not pleasant to start with. Should what appears regarding soft foods or anything else in connection with poultry arouse sufficient interest to create a desire to know more, any detailed information will be gladly supplied on application to the Department.

Notes.

One of the results of the very wet season we have experienced will probably be an increase, particularly amongst the Asiatic breeds, of elephantiasis or "scaly legs." This is caused by a parasitic insect, and is consequently very contagious; and should be promptly attended to. The scales on the legs of the affected bird become rough, and the leg appears to thicken. When these symptoms are noticed, and a good poultry man or woman will notice them immediately, the bird should be caught, its legs thoroughly washed with soap and warm water, and then a mixture of sulphur and lard (sulphur ointment) well rubbed in. If taken in time one

rubbing is usually sufficient. Although the bird affected does not appear to droop, it may be taken for granted that a bird suffering from elephantiasis is not fit for the table; and this is a point which should be carefully looked at when buying fowls.

Now is a good time to purchase a well-bred cockerel to run with any crossbred hens there may be about the farm. In cases where the farmer does not care to go to the expense of purchasing a pen of thoroughbreds this system will be found an excellent alternative. All the chief breeders will have a number of young male birds, big framed and with excellent constitutions, yet quite useless for their purposes from some defect in colour. Although this is of importance to a fancier it is immaterial to the farmer who simply wants to improve the stamina of his common fowls. The selection of breed should be according to the most marked characteristics of a majority of the hens, if they have any. In any case, there can be no harm in purchasing an upstanding, healthy young Australian game, as they cross well with almost any breed.

General Notes.

The Vineyard and the Cellar.

In consequence of the absence from Sydney of Mr. Despeissis, who is engaged in judging vineyards in connection with the national prize competition, the chapter in the series under the above heading has not been prepared. In the meantime we cannot do better than refer vignerons to Mr. Despeissis' article on "Wine Fermentation," which appeared in Vol. II. pt. 6, and express the hope that the series will be resumed in our issue for March next.

Some Results of Spraying.

As showing the beneficial results of spraying fruit-trees, the following extract from a report by Inspector T. G. Treseder, dated 29th October, 1892, on a visit to the orchard of Mr. Ezzy, at Millthorpe, should be an incentive to orchardists to act upon the suggestions offered by the Department.

Mr. Treseder, says "Mr. Ezzy's place is in much better condition than many others I have seen, and I attribute this to nothing else but spraying the trees with the different mixtures advised in the *Agricultural Gazette*. Mr. Ezzy showed me three apricot trees which he sprayed early in spring with *Eau Céleste*. The first time of spraying was just before the trees burst into leaf; the second time when the fruit was nicely formed, and the leaves about the size of a shilling (this time only two trees), and the third time one tree when it advanced in growth about 3 inches. It is surprising to notice the difference in these three trees although they are standing close to each other. The one sprayed three times is as bright as anyone could wish to see a tree, free from shot-hole fungus in the leaves, and from scab on the fruit. That sprayed twice a shade worse in all respects; while that sprayed once is really badly infected with scab on the fruit, and shot-hole fungus on the leaves.

"The pear trees were infected worse than any other fruits with mite, and I sprayed them with resin and soda to the great satisfaction of the spectators. There was a little peach aphis on one or two of the trees, and I sprayed these with the same mixture, the spectators being highly pleased to find that the aphides were immediately destroyed.

"Mr. Ezzy showed me a Windsor pear which he had treated with the same mixture early in spring. This tree had for years borne scarcely a pear. This year he has a fair crop, and next year he expects to save 50 or 60 per cent. of the set blossom. In order to prove beyond doubt that the spraying did save the crop, I may mention that another Windsor pear-tree close by was not treated, and is in a dreadful state both with black spot and pear mite."

The Export of Meat.

A correspondent writing recently to the *Sydney Morning Herald* calls attention to the apparent uselessness of reminding stock-owners of the common practice all over Australia of preserving meat. He points out that from the earliest times in Australia it has been the habit of stockmen to take the bones out of meat, slightly salt it, season it with saltpetre and sugar, and then hang it up to dry. Instead of this, "still they go on boiling down, freezing, potting, panning, extracting, and making salt junk for ships' use." The point contended for is that there is both less risk and less expense in the Australian process, by which the more costly carriage in the freezing chamber would be dispensed with. Without expressing any opinion as to the success likely to meet with such a product on the London market as compared with frozen meat; it is safe to say that this meat is infinitely more palatable than the salt junk usually to be obtained on shipboard, and certainly not more expensive to cure.

The New Style of Farming.

In the *Australasian* of November 26th, 1892, appears an article under this head, in which the writer calls attention to the necessity of growing a variety of crops in order to make farming a profitable pursuit. He says, "In the northern parts of the Colony of Victoria farmers generally have attempted to make a fortune by wheat-growing. Very few of those, however, who have devoted their attention solely to cereals have done more than earn a bare living. The most wide-awake selectors knew such would be their fate from the first, and they wisely avoided putting all their eggs into one basket. They found time to plant a few fruit trees and vines, while the raising of vegetables also formed a feature of their experiments. . . . . In my travels through the Victorian Colony I have never met a farmer owning 640 acres who has paid for his land, built a substantial house, and generally raised himself to affluent circumstances by wheat-growing alone. Now this is an extraordinary and perhaps humiliating statement to make, but it is based on fact all the same. I have never come across—and I would travel a long way to see him—the selector who has secured his independence by wheat and nothing but wheat."

In calling attention to this article, the Departmental Inspector of Cereals points out that the statements may to some extent be applied to farmers in this Colony. As he is in the best possible position to ascertain the true state of affairs, this paragraph is published as a warning both to farmers who so far have adhered to the practice now condemned and to those who are about commencing operations.

Tomatoes as Insect Clearers.

According to a translation in the Melbourne *Weekly Times* from a South American paper, tomato leaves have proved to be value in an unanticipated direction. It appears that the owner of a number of peach trees attacked by *curculio* placed tomato leaves round the trunks and branches to shade them from the sun, and was surprised to find, on visiting the orchard next day, that the trees so treated were entirely clear of insects. Acting on the hint thus obtained, he steeped a quantity of fresh tomato leaves in water, and sprinkled the liquor over some peach, rose, and orange trees, which had

not previously been treated with the tomato leaves, and in two days, of the numerous insects of all kinds which had infested the trees, not one was to be seen.

The Department would be glad to have the experience of any fruit-grower who may have tried growing tomatoes among fruit trees; also to know whether the above-mentioned decoction has been tried in the Colony, and, if so, with what effect.

New Wheats.

The special attention of wheat-growers is called to the fact that a good number of the new wheats sent out by the Department have proved very suitable to certain districts.

Those who wish to inform themselves concerning the facts will do well for the present to address themselves to the farmers who, in the ten different districts, undertook to grow those wheats during the past season.

The names and addresses of those experimenters are as follows:—

Principal Thompson, Hawkesbury Agricultural College, Richmond.
W. Farrer, Lambrigg, Queanbeyan.
Joseph Faint, Kelly's Plains, near Armidale.
Thomas Quick, Woodlands, Tamworth.
Thomas Bragg, Allington, Narramine, near Dubbo.
T. C. Worboys, Spring Hill, near Orange.
Edward Taylor, Rose Hill, Young.
H. D. Coker, Brookfield, Jindalee, near Cootamundra.
Robert Young, Umaralla, near Cooma.
B. B. Bennett, Brucedale, Wagga Wagga.
G. F. Berthoud, Riverside, Corowa.

The kinds of wheat sent for trial to each of the experimenters were as follow:—Blount's Lambrigg, Leak's, Ward's Prolific, Smith's Nonpareil, Steinwedel (one bushel of each); Belatourka, Queensland Defiance, Talavera, Town and Country, Mummy, Medeah, Pugh's Allora Spring, Farmer's Friend (half bushel of each); 5-lb. sample White Hogan; 1 lb. of Summer Club, King's Jubilee, Early Para and Australasian Wonder; small packets, from ½ lb. to 1 oz., Victorian Defiance, Rattling Tom, Red Californian, Square-headed Sicilian, Fillbag, Cooke's, Goldsmith's Pedigree, Blount's Fife, Broderick's, Ward's Prolific (Marshall White), Sicilian Boart, Australian Glory, Manitoba, Tourmaline, Niagra, Jordan's, Fluorspar, Bega Wheat, Quartz 58A, Anglo-Australian or Anglo-Canadian, Jacinth, Improved Fife. In addition to which, small packets, eleven of each, were sent of cross-fertilised wheats.

Sisal Hemp Plants (*Agave rigida*, Mill., var. *Sisalana*.)

As announced in a previous number of the *Agricultural Gazette* the Department has been in communication with the Colonial Secretary of the Bahamas, with regard to obtaining a quantity of these fibre plants for distribution to persons in this Colony desirous of experimenting with them in suitable localities. We regret to learn, however, from a reply just received through the Agent-General, that the exportation of the sisal hemp plant from Bahamas for any purpose whatever is forbidden by statute until the expiration of 1898. The Department will now endeavour to obtain plants of this variety from some other reliable source.

Appointment of Tobacco Experts.

In connection with the encouragement of the tobacco industry in this Colony the following temporary appointments have been made by the Minister:—Mr. Samuel Lamb and Mr. G. F. Sutherland. These officers are now visiting the more important tobacco-growing districts in the Colony with the view of giving information to growers with regard to best methods of cultivation, most suitable varieties, and approved methods of harvesting and curing the leaf, which, it is hoped, may lead to the industry being placed on a more satisfactory basis.

Quotations for Agricultural Lime.

We have received numerous inquiries from farmers and fruit-growers with regard to procuring, at a reasonable price, lime suitable for applying to their soils; and in response to the Department's invitation the following quotations have been submitted by manufacturers of this article:—

Messrs. J. and F. Toyer, lime and cement manufacturers, Liverpool-street, Sydney, offer to supply in trucks at Ben Bullen Railway Siding (Mudgee line), 122 miles from Sydney, genuine, well-burnt agricultural lime at 7s. 6d. per ton, bags extra. The rail freight from Ben Bullen to Darling Harbour is 10s. 8d. for a single ton, and 9s. 4d. per ton for a truck load if not less than six tons. If desired, they can deliver the lime at any of the steamer wharfs in Sydney at 21s. per ton, bags extra.

Mr. John Fry, of Nos. 237, 239, Castlereagh-street, Sydney, offers to deliver in Sydney at steamer's wharf agricultural lime in bags at 21s. 6d. per ton.

Number of Vignerons in New South Wales.

NUMBER of Vignerons in New South Wales, also acreage under vines and production for the year 1891–92.

Electorates.	Number of Growers	Area. Wine-making.	Area. Table-use.	Area. Not bearing.	Area. Total area.	Production. Wine.	Production. Brandy.	Production. Table use.
		acres.	acres.	acres.	acres.	gallons.	gallons	tons of fruit.
A.—*Northern Division*—								
1. Coast.								
Richmond	54	36	21	22	79	2,700	...	23
Clarence	3	...	8	...	8	......	...	3
Grafton	24	23	9	7	39	3,680	...	14
Macleay	8	6	7	1	14	1,650	...	16
Hasting and Manning ...	58	96	45	31	172	25,760	...	115
Totals	147	161	90	61	312	33,790	...	176
2. Table-land.								
Inverell	45	143	27	17	187	38,291	926	33
New England	5	16	...	6	22	3,750	...	...
Glen Innes...	2	14	...	...	14	3,600	...	...
Tenterfield	5	...	3	...	3	......	...	3
Tamworth	23	41	23	14	78	11,460	...	54
Totals	80	214	53	37	304	57,101	926	90
3. Western Slopes.								
Gunnedah	12	1	9	2	12	120	...	9
Gwydir	12	...	12	14	26	......	...	18
Namoi	36	1	31	12	44	120	...	47
Totals	60	2	52	28	82	240	...	74
Totals—Northern Division ...	287	377	195	126	698	91,131	926	340
B.—*East Central Division*—								
4. Coast.								
Gloucester	3	31	2	12	45	3,000	...	2
Durham	48	180	11	18	209	75,260	27	26
Newcastle	...	...	...	...	...	......	...	...
Morpeth	5	38	6	18	62	10,020	...	6
Northumberland	17	5	17	...	22	1,300	...	25
Maitland, East	8	18	11	2	31	4,200	...	26
Maitland, West	6	...	8	...	8	......	...	19
Hunter	157	879	131	181	1,191	292,380	1,662	254
Patrick's Plains	108	308	113	137	558	73,550	...	137
Wollombi	36	25	10	23	58	4,470	...	11
Hawkesbury	100	69	107	44	220	17,520	...	164
Nepean	113	173	108	90	371	29,096	374	95
Totals	601	1,726	524	525	2,775	510,796	2,063	766

NUMBER of Vignerons in New South Wales—*continued.*

Electorates.	Number of Growers	Area. Wine-making.	Area. Table use.	Area. Not bearing.	Area. Total area.	Production. Wine.	Production. Brandy.	Production. Table use.
B.—*East Central Division*—(continued).		acres.	acres.	acres.	acres.	gallons.	gallons	tons of fruit.
5. Metropolis and Environs.								
Metropolis	...	...	...	...	...	......	...	...
St. Leonards	16	...	27	13	40	......	...	26
Canterbury	9	3	14	5	22	450	...	28
Parramatta	...	...	...	...	...	......	...	...
Central Cumberland ...	510	41	791	284	1,116	6,770	...	1,646
Totals	535	44	832	302	1,178	7,220	...	1,700
6. Table-land.								
Hartley	3	...	...	3	3	......	...	...
Upper Hunter	40	128	17	9	154	35,600	141	16
Mudgee	55	117	76	27	220	10,088	...	53
Macquarie East	4	3	7	6	16	400	...	7
Macquarie West	...	...	...	...	...	......	...	...
Orange	12	3	13	18	34	900	...	14
Carcoar	19	9	10	8	27	550	...	14
Molong	9	8	8	4	20	1,600	...	14
Wellington	23	29	27	7	63	3,435	60	44
Totals	165	297	158	82	537	52,573	201	162
7. Western Slopes.								
Bogan	26	53	53	13	119	8,330	...	89
Forbes	23	15	23	32	70	3,300	...	44
Grenfell	14	33	20	25	78	4,090	...	63
Totals	63	101	96	70	267	15,720	...	196
Totals—East Central Div. ...	1,364	2,168	1,610	979	4,757	586,309	2,264	2,824
C.—*Southern Division.*								
8. Coast.								
Camden	83	64	69	177	310	14,280	148	169
Kiama	...	...	.	...	...	......	...	...
Illawarra	10	1	11	2	14	370	...	52
Shoalhaven...	3	1	4	1	6	200	...	10
Eden	8	7	21	7	35	1,000	...	21
Totals	104	73	105	187	365	15,850	148	252
9. Table-land.								
Argyle	9	1	16	5	22	300	..	14
Goulburn	2	...	5	...	5	......	...	5
Braidwood	6	7	4	8	19	1,100	50	2
Queanbeyan	2	...	2	8	10	......	...	3
Monaro	1	...	6	...	6	......	...	4
Yass Plains	3	2	...	2	4	600	...	...
Boorowa	6	13	1	5	19	2,000	50	3
Young	28	50	40	30	120	6,150	20	34
Gundagai	15	21	8	5	34	3,690	30	6
Tumut	5	9	5	...	14	1,762	...	4
Totals	77	103	87	63	253	15,502	150	75

NUMBER of Vignerons in New South Wales—*continued.*

Electorates.	Number of Growers	Area.				Production.		
		Wine-making.	Table use.	Not bearing.	Total area.	Wine.	Brandy.	Table use.
C.—*Southern Division*—(continued).		acres.	acres.	acres.	acres.	gallons.	gallons	tons of fruit.
10. Western Slope.								
Hume	121	438	39	799	1,276	74,812	731	26
Albury	93	636	18	62	716	120,875	1,895	37
Murray	19	...	12	26	38	......	...	14
Murrumbidgee	47	47	62	41	150	8,128	...	104
Totals	280	1,121	131	928	2,180	203,815	2,626	181
Totals—Southern Division ...	461	1,297	323	1,178	2,798	236,167	2,924	508
D.—*Western Division.*								
Balranald	6	3	3	1	7	300	...	4
Wentworth	2	1	2	...	3	200	...	3
Wilcannia	1	...	...	2	2	......	...	...
Bourke	10	...	15	...	15	......	...	15
Sturt	3	...	...	1	1	......	...	...
Totals—Western Division ...	22	4	20	4	28	500	...	22
Totals—New South Wales ...	2,134	3,846	2,148	2,287	8,281	913,107	6,114	3,694

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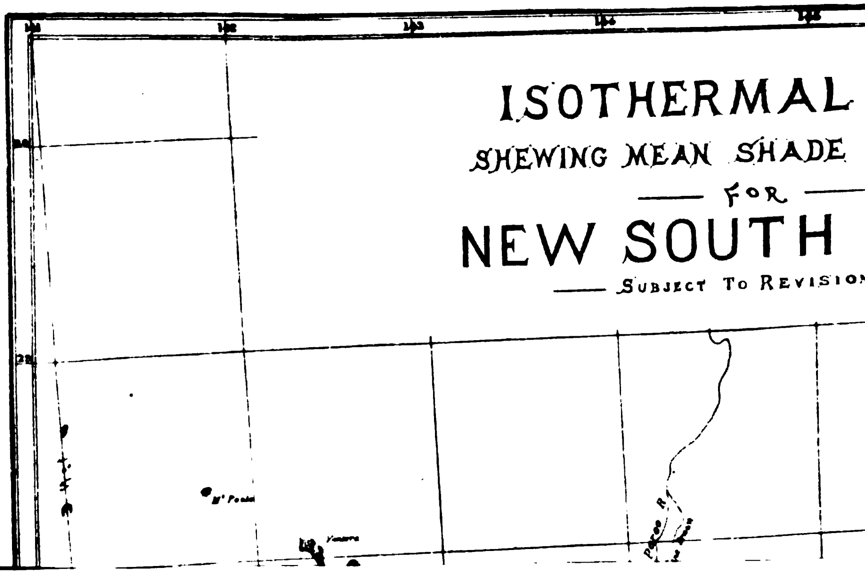
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FOR
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SUBJECT TO REVISION

THE

GRICULTURAL GAZETTE

OF

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Panicum flavidum, Retz.

"Yellow-flowered Panick Grass."

The Grasses of Australia.

(*Continued from Vol. IV, Part 2, page 83*).

BY F. TURNER,
Department of Agriculture.

PANICUM FLAVIDUM, *Retz.* "Yellow-flowered Panick Grass."
Flora. Austr., Vol. VII, p. 474.

STEMS erect, branching at the base, rather rigid, attaining 1 foot to 2½ feet or rather more. Leaves acute, sometimes rather broad, but the margins involute when dry, glabrous except a few short hairs at the orifice of the sheath. Panicle of several often numerous erect distant branches or sessile spikes, the lowest sometimes above ½ an inch long, the upper ones shorter, the rhachis flexuose, slightly dilated. Spikelets sessile in about two rows, in the typical form very oblique, ovoid, about 1½ lines long or rather more in several Australian specimens. Outer glume very short, broad, and obtuse; the second glume the largest, broad, several nerved, very concave, and incurved; the third smaller, flat on the back, enclosing a palea large and broad in the typical form, but no stamens. Flowering glumes usually shortly acuminate. Grain enclosed in the hardened fruiting glume and palea, but free from them. In the variety *tenuior* the spikelets are rather small, not quite so oblique, the palea within the third glume usually very small, the fruiting glume very rugose.

A perennial species found in New South Wales, Queensland, and North Australia, and, according to Mr. Bentham, it extends over a greater part of tropical Asia also. In this country the typical form is generally to be found growing on deep rich soils in the interior, and in such situations it will often remain green during the driest of weather. In an ordinary season it produces a great amount of rich succulent herbage, which stock of all descriptions are remarkably fond of and fatten on. Pastoralists very justly hold this grass in much esteem, and many consider that it is one of the best that grows in the interior. It is fairly plentiful in many parts of the country, but this may be accounted for by the fact that, under ordinary circumstances, it produces a great amount of seed. In fact, I have often seen the panicles lying prostrate on the ground from the weight of seed they carry. In the interior this grass is well worthy of conservation where it may already be growing and disseminating where it does not already exist. It would also well repay systematic cultivation, either for hay or pasture. There would be no difficulty in bringing this grass under cultivation, because from a small reserved enclosure as much seed could be gathered in a short time as would sow a large area. The seeds usually ripen during October, November, and December, but occasionally in the autumn months in a good season.

A

Amongst a number of botanical specimens collected by the late K. H. Bennett in the Lachlan River district of New South Wales, which were sent to me for identification, was this grass, to which the following note was appended:—"Amongst the many species of grasses found in this part of the Colony there is none that stock are more fond of than this. It is met with both on the plains and in the back country, more particularly in the latter, and is only found on rich, sandy, or loamy soil, and amongst timber, and, as a rule, beneath the shelters of some spreading tree or large bush. It is perennial, and seeds in October and November." There is a variety (*var. tenuior*) of this species which is figured in this issue, and which grows fairly plentifully in some of the coastal districts of New South Wales and Queensland. Although it rarely ever exceeds 1 foot in height, it is a good pasture grass, and in sheltered situations will grow nearly all the year round. It is also a good species to withstand dry weather, and its vivid green leaves may often be seen when some of the surrounding grasses are dry looking. It is a prolific seed bearer, and the panicles often lie prostrate on the ground from the weight of grain they carry.

Reference to Plates.—A, showing the arrangement of the spikelets on the rhachis; B, showing the relative size of the outer glume on the spikelet; C, spikelet opened out, showing the four glumes and two paleas; D, grain, back and front views, all variously magnified.

Panicum flavidum, Retz. Var. tenuior.

"Yellow-flowered Panick Grass."

116-48-93

Eleusine ægyptiaca, Pers.

"Crow-foot or Finger Grass."

ELEUSINE ÆGYPTIACA, *Pers.* "Crow-foot" or "Finger Grass."

Flora Austr., Vol. VII, page 615.

STEMS tufted or creeping and rooting at the base, and shortly ascending like the *Cynodon dactylon*, or rarely above 1 foot high. Leaves flat, ciliate, flaccid, with long points. Spikes usually three to eight, digitate, under ½ an inch in most of the Australian specimens, but sometimes 1 inch long, the angular rhachis prominent on the upper or inner side, the spikelets regularly and very closely packed at right angles to it on the opposite side. Outer glume about 1 line long, acute; the second broader, obtuse or emarginate; the keel produced into a short dorsal awn; the rhachis of the spikelet produced above the outer glumes but glabrous. Flowering glumes broad, complicate, tapering into short spreading points. Pericarp loose over the enlarged ovary, disappearing from the ripe rugose seed.

This species is found in all the Australian colonies, and principally in the arid interior. It is also indigenous in Asia, Africa, and America. In this country it is generally to be found growing on the richest of soils, and sometimes on land that is periodically inundated. In many districts it is fairly plentiful, but this may be accounted for by the fact that under ordinary conditions it produces an abundance of seed, which germinates readily in the spring of the year should there be sufficient moisture in the earth. In a dry season the growth is dwarf and tufty, but under more favourable conditions the weak stems take root at nearly every joint, and the lateral growths lengthen out; rarely, however, do they exceed much more than 1 foot in height. During the hot summer months, and in an ordinary season, it makes most of its growth. Should heavy rains fall in January or February, however, the grass will often make considerable growth during the early autumn months. Its herbage is rich and succulent, and is much relished by all herbivora, sheep being particularly fond of it. All the pastoralists that I have spoken to about it are agreed that it is a most nutritious grass. I have had it under experimental cultivation, and it yielded a great amount of herbage during the hotter part of the year; therefore, I can highly recommend it for temporary pasture in the interior or to be grown for hay. There would be no difficulty in bringing this grass under systematic cultivation. As before observed, it produces an abundance of seed when it is allowed to grow undisturbed for a period. From a small reserved enclosure as much seed could be gathered in a short time as would sow a large area. The seeds usually ripen during the summer months.

According to Le Maout and Decaisne, a decoction of the seeds of this grass is renowned in Africa as an alleviator of pains in the region of the kidneys, and its herbaceous parts are applied externally for the cure of ulcers.

According to Dr. Watt, the seeds are eaten by the poorer classes in India, especially during times of scarcity, and it is generally considered to be a very nutritious fodder grass for cattle, being both fattening and milk-producing.

Reference to Plate.—A, spikelet opened out; B, floret; C, three different views of the rugose grain, all variously magnified.

New Commercial Crops for New South Wales.

(Continued from page 5.)

BY FRED. TURNER.

THE CULTIVATION AND USES OF THE BAEL OR BENGAL QUINCE (*Ægle marmelos*, Corr.)

THE bael, or Bengal quince, belongs to the Citrus family, and is extensively cultivated all over India. In a wild state it is generally to be found growing in dry, hilly places, reaching, in the western Himalayan forests, to the altitude of 4,000 feet. It is a medium-sized deciduous tree, and is armed with stout axillary spines. Some authorities state that the cultivated trees in India are generally free from spines, but the trees that I have had under cultivation in this country had spines on them, though they were not nearly so formidable as those that are to be seen on many of the Citrus family growing here. The leaves of the bael tree are compound, and are composed of three leaflets, each one of which is from 1 to 2 inches long. The fragrant white flowers, which are borne in great profusion on established trees, are about 1 inch in diameter, and are arranged in axillary or terminal panicles. These are succeeded by fruits which vary in size and shape from globular, and 2 to 5 inches in diameter, to ovoid, oblong, or pyriform. The shell of the fruit is smooth, hard, and about ⅛ of an inch thick, but it is easily broken. The ripe pulp is of a pale orange or sometimes approaching a flesh colour; is highly fragrant, and most delicious. At least, I have thought so when eating it. If a spoonful or so of the ripe pulp is mixed with a tumbler of water it yields a pleasant, orange-coloured sherbet, which makes a refreshing drink on a hot day.

The bael tree has been cultivated and it has borne fruit for a number of years in some of the coastal districts of Queensland. Therefore, it is thoroughly acclimatised in that portion of the continent.

Although this tree belongs to the Citrus family, most varieties of which grow so freely in the coastal districts of New South Wales, it is not so hardy as many of them. Therefore, I do not think it can be grown with much success very far south of the Clarence River, but between that stream and the northern boundary of this territory there are many eligible sites where the tree would grow. The bael tree should be liberally planted in suitable places in this Colony, not only for its ornamental appearance when in flower and for the sake of its delicious fruits, but from a medicinal point of view, of which I shall have something to say under the proper heading.

Ægle marmelos, Corr.

"Bael or Bengal Quince."

Soil and Situation.

I have seen bael trees growing, both on a rather strong deep loam and on a shallow but a rich soil, and under these conditions they grew very well. The tree seems to adapt itself almost to any kind of soil, provided that it is not too tenacious, and is of fair depth, and naturally well drained. Nothing appears to harm the plant more than stagnant moisture about its roots. Before any trees are planted the soil should be prepared in a similar way to that intended for orange trees, and if it is not naturally well drained it should be artificially attended to. Those trees that I have seen appeared to grow better in a situation having a north-easterly aspect, that was fairly well sheltered from southerly and westerly winds, than in any other position.

Propagation.

The bael tree can be propagated by layers and from seed. The best time to put down layers is in the spring of the year, and in an ordinary season they should be ready to transplant to their permanent quarters in the following autumn. If the season should prove dry after the layers are put down it will be advisable to water them occasionally. This will not only encourage root action and a vigorous growth, but, speaking generally, such plants will take more readily to their new quarters after being transplanted than those that are left to take care of themselves. The best time to sow the seed is as soon as the fruit is ripe, then, with care, all the good ones will germinate and grow into strong plants. To ensure success, the seeds should be sown singly in ordinary flower-pots, or extemporised small wooden boxes, from which the young plants could be transplanted to their permanent quarters without disturbing their roots. A few coarse cinders or charcoal should be placed at the bottom of each pot or box to act as drainage; over this place a few partially-decayed leaves, then fill up to within an inch of the surface with a light, free, open soil, press it firmly down, and on the top of this, but in the centre of each pot or box, plant one of the seeds and cover it with quarter of an inch of soil. The pots or boxes should then be set on ashes, which will prevent worms getting into the soil, in a situation where the seedlings will have plenty of light, but at the same time be protected from the fierce rays of the mid-day sun. The seedlings must be watered regularly, but with discretion. On no account should the soil be allowed to become soddened with water, or the young plants will soon present a sickly appearance, from which it would take them some time to recover. During the first winter it will be advisable to place the young seedlings under glass or other temporary shelter. Under ordinary treatment the seedlings that are raised in this way will be ready for transplanting to their permanent quarters in about twelve or eighteen months from the time that the seeds were sown.

Planting.

This is best done in March or September, after rainfall if possible, or whilst the soil is in a sufficiently moist but easily-worked condition. When planting care must be taken that the trees are put very little deeper in the soil than when they stood in the pots or boxes. Nothing does so much harm to the Citrus family as deep planting; indeed, the same may be said of every fruit-bearing tree. Care should also be taken not to disturb their roots any more than is absolutely necessary unless they have wound round each other; then they should be carefully opened out and covered with fine soil. If a number of seedlings have been raised for planting in a particular

place, they should at least be set out 20 feet apart, so as to allow them plenty of room to develop into fine trees. After each tree has been planted it should be tied firmly to a stake to prevent injury from winds until it becomes well established. If dry weather should ensue after the young trees are set out they should be watered occasionally until fresh root action takes place, which, under ordinary circumstances, will not be long. A light mulch round each young tree would be an advantage, inasmuch as it would keep the soil cool about its roots, and prevent a too-rapid evaporation of moisture from the ground. The cultivation that is required is similar to that given to Citrus trees in general. The only pruning that is necessary will consist in keeping a clean stem for a few feet above the ground, and in cutting back exuberant growths, and cutting out those that cross each other, so that the tree will form a shapely head.

For the following interesting particulars about the bael tree I am indebted to Dr. Watts' "Dictionary of the Economic Products of India":—

"Food.—The fruit when ripe is sweetish, wholesome, nutritious, and very palatable, and much esteemed and eaten by all classes. The ripe fruit, diluted with water, forms, with the addition of a small quantity of tamarind and sugar, a delicious and cooling drink.

Domestic and sacred uses.—The fruit is nutritious, warm, cathartic; in taste delicious, in fragrance exquisite; its aperient and detersive quality and its efficiency in removing habitual costiveness have been proved by constant experience. The mucus of the seed is for some purposes a very good cement. The fruit is called *Shriphula*, because it sprang, say the Indian poets, from the milk of *Shri*, the goddess of abundance, who bestowed it on mankind at the request of *Jowarra*, whence he alone wears a chaplet of *Bilva* flowers; to him only the Hindus offer them; and when they see any of them fallen on the ground, they take them up with reverence and carry them to his temple. (*Roxb. in As. Res.*, vol. II, 340.)

This is one of the most sacred of Indian trees, cultivated near temples and dedicated to *Siva*, whose worship cannot be completed without its leaves. It is incumbent upon all Hindus to cultivate and cherish this tree, and it is sacrilege to cut it down. (*Dr. U. C. Dutt.*)

In Peshawar large numbers of snuff-boxes for Afghans are made from the shell of the fruit, which is prettily carved over and fitted with a small bone plug for the opening in the end, which serves as entrance and exit for the snuff. (*Stewart, Pb. Pl.*).

The young dry shell is also largely used for medicine dishes and bottles.

Structure of the wood.—Yellowish white, hard, with a strong aromatic scent when fresh cut; no heart wood; not durable; readily eaten by insects. Weight, 40 lb. to 50 lb. (Brandis); Wallich gives 49 lb.; Mr. Gamble's specimens averaged 57 lb. Used in construction for the pestles of oil and sugar mills, naves, and other parts of carts, and for agricultural implements. The wood is also valued for making charcoal, but it is not often used. (*Stewart, Pb. Pl.*) The wood is used in the Pauch Mahâls for oil mills.

The gum.—The stem yields a good gum, occurring in tears, like gum arabic, or in fragmentary pieces, resembling coarse brown sugar.

The dye.—A yellow dye is obtained from the rind of the fruit; the unripe rind is also used along with myrabolans in calico-printing.

The medicinal properties of bael.—No drug has been longer and better known, nor more appreciated by the inhabitants of India than bael. The unripe fruit acts as an astringent; the ripe fruit, taken in the fresh state, is laxative, but the dried ripe pulp is only mildly astringent. By some authors the astringency is denied. A few chemists maintain that the fruit contains

tannin, while others assert that this is not the case. The drug used in India for diarrhœa and dysentry is the roasted or sun-dried unripe fruit, cut up into slices.

Synopsis of the parts of the plant as used medicinally:—

(*a*) The unripe fruit is cut up and sun-dried, and in this form is sold in the bazaars in whole or broken slices. It is regarded as astringent, digestive, and stomachic, and is prescribed in diarrhœa and dysentry, with debility of the mucous membrane, often proving effectual in chronic cases after all other medicines have failed. It seems specially useful in chronic diarrhœa. A simple change of the hours of meals and an alteration in the ordinary diet, combined with bael fruit, will almost universally succeed.

(*b*) The ripe fruit is sweet, aromatic, and cooling. Made into a morning sherbert, cooled with ice, it is pleasantly laxative, and a good simple cure for dyspepsia, and is useful in febrile affections. The dried ripe pulp is mildly astringent, and may be used in dysentry. A useful popular preparation, made in India, is the bael marmalade, which may be taken like jam at the breakfast table in convalescence from chronic dysentry or diarrhœa.

(*c*) The root (and sometimes the stem) bark is made into a decoction which is used in the treatment of intermittent fever. It constitutes an ingredient in the *dasamul* or ten roots. It is given in hypochondriasis and palpitation of the heart.

(*d*) The leaves are made into poultice, used in the treatment of ophthalmia. The fresh juice is bitter and pungent, and, diluted with water, is praised as a remedy in catarrhs and feverishness.

(*e*) The astringent rind of the ripe fruit is employed in dyeing and tanning. It is also sometimes used medicinally.

(*f*) The flowers are deemed fragrant by the native physicians.

The difference between the appearance and properties of fresh ripe fruit and of the dried slices of unripe fruit sold in the druggists' shops and exported to Europe must not be overlooked. The ripe pulp is of a pale orange or flesh colour; is deliciously fragrant, and yields with water a pleasant orange-coloured sherbert, slightly laxative. The dried slices give a reddish solution, acid and astringent in its action (or by some authors considered stimulant to the mucous membrane, but not astringent), and not possessed of the characteristic fragrance of the ripe fruit. The dried slices are prepared from the unripe fruit before the pulp has either become flesh-coloured or acquired its characteristic odour. Dr. M. Sheriff says it is "a tonic, stomachic, febrifuge, nauseant, and a remedy in dysentery, scurvy, and apthæ. It is not astringent, and therefore not useful in all forms of dysentery and diarrhœa. Acute dysentery is the disease which is most benefited by it, particularly in its first stage. It seems to exercise a greater influence in altering the nature of the motions than in diminishing their frequency. Its usefulness is greatly enhanced by the combination of opium." (*Pulv. Ipecac. Co.*)

Officinal preparations:—(1.) Extract of bael, made from the fresh unripe fruit. Dose from half a drachm to one drachm twice or thrice daily. (2.) Liquid extract of bael, prepared from the dried slices of unripe fruit. This possesses in a much less degree the properties of the extract. Dose one to two fluid drachms. (3.) Dr. M. Sheriff says that a powder of the dried pulp is the most convenient form of administration; it keeps well in tight bottles. Dose as a tonic, 12 to 15 grains; as a febrifuge and remedy for scurvy and apthæ, 18 to 20 grains; as a nauseant and remedy in dysentery, 20 grains to 2 drachms.

Opinions regarding the unripe fruit.—Pulp of green fruit, softened by roasting and sweetened with sugar candy, is useful in chronic diarrhœa and dysentery. The "sharbat" of ripe fruit is a pleasant cooling drink, but heavy of digestion, often causing acidity and heartburn. (*Ass. Surg. Shib Chunder Bhuttacharji.*)

I have used unripe bael fruit in two ways: (*a*) Entire bael fruit, partially burnt, about half or one-third of each fruit to a man once a day. The burning softens the pulp and makes it more digestible (*b*) Unripe bael cut into slices and sun-dried and boiled before eating with a little sugar. In both ways it has been found to be a mild astringent, stomachic, and nutritive, most useful in chronic dysentery and diarrhœa, slowly but steadily reducing the number of motions and the quantity of mucus. The ripe fruit made into a sherbet is a mild laxative and cooling drink. A little *dahi* or tamarind and sugar is added to give a sub-acid taste, and to increase the cooling laxative property. (*Surgeon D. Basu.*)

I have used a strong decoction of the dried and sliced fruit in chronic dysentery and diarrhœa, also the sherbet and pulp of the ripe fruit and the different forms of bael powder and preserve. (*Surgeon Picachy*).

The unripe fruit is used as a pickle. It is also made into preserve, and commonly used for cases of dysentery. (*Surgeon-Major Robb*).

Regarding the ripe fruit and sherbet.—The use of ripe fruit in the form of sherbet is very valuable in seasons of prevalence of bowel complaints and cholera. The strained pulp of the half-roasted unripe fruit is more efficacious than the extracts sold by English druggists in diarrhœa and dysentery. (*Surgeon R. L. Dutt, M.D.*)

Sherbet made from the ripe fruit is most useful in chronic dysentery and diarrhœa. (*Surgeon C. H. Joubert.*)

The ripe fruit is an excellent laxative. The sherbet should be made thick enough to be eaten with a spoon, and not, as many servants make it, so thin that it can be drunk. The quantity required to produce a laxative effect is a small tumblerful. A mixture of half milk and half sherbet is an agreeable drink. (*Surgeon E. Borill*).

A very pleasant and extremely useful fruit. Thick sherbet made of the ripe fruit is the best and surest laxative I know; the quantity necessary to produce this effect being an ordinary tumblerful. Very useful in dyspepsia and habitual constipation. (*Surgeon G. Price.*)

The pulp of the fresh fruit in the form of a thick sherbet is much recommended in scurvy, acting at the same time as a purgative. (*G. W.*)

In sub-acute and chronic dysentery often invaluable, taken in the form of sherbet. (*Surgeon J. Maitland, M.B.*)

Regarding the leaves.—Leaves are very efficacious when pounded into a pulp without any admixture of water and applied cold in the form of a poultice, to unhealthy ulcers. (*Ass. Surgeon A. C. Mukerji.*)

The fresh juice of the leaves acts as a mild laxative in cases of fever and catarrh, and has, probably, the effect of remedying these conditions. (*D. C. Shome.*)

The decoction of the leaves is used as a febrifuge and expectorant. (*Ass. Surgeon N. L. Ghose.*)

The juice of the fresh leaves has a laxative action.—*Surgeon K. D. Ghose.*

Regarding the root.—The root is said by the people here to be an antidote against poisonous snake-bite. (*Surgeon C. J. W. Meadows.*)

For habitual constipation, root bark 1 oz., boiling water 10 oz. Dose, 1 to 2 oz. (*Apothecary T. Ward.*)"

The dried half-ripe fruit is official in the *British Pharmacopœia.* For the following interesting remarks, I am indebted to Bentley and Trimen "Medicinal Plants," "Collection and Commerce":—For medicinal use the fruit should be collected in a half-ripe state and carefully dried, for if allowed to ripen it entirely loses its astringent properties, and becomes a mild aperient. It is imported from Malabar and Coromandel.

General characters and composition:—Bael fruit, or, as it is commonly called, Indian bael, is of a roundish form, about the size of a large orange, and is covered with a hard woody rind. It is rarely imported entire, but is usually found in commerce in dried slices or in fragments consisting of portions of the hard woody rind and adherent dried pulp and seeds. The rind is about 1½ lines thick, and is covered with a smooth, firmly-adherent, pale brown or grayish epicarp, and, internally, as well as the dried pulp, has a brownish-orange or cherry-red colour. This colour of the pulp is, however, only superficial, for when broken it is seen to be colourless. It has no marked odour, but the taste of the pulp is mucilaginous and feebly acid, without any astringency, sweetness, or aroma.

Other products of the bael-tree:—The ripe fruit, which is known in India as the Bengal quince, is said to have a very agreeable odour and taste. It is described as a mild aperient, and the juicy pulp, when mixed with water and sweetened, is employed as a refrigerant drink in fevers and inflammatory affections attended with thirst. A preserve and a jelly are also prepared from the ripe fruit with sugar, and are said to be beneficial in habitual costiveness.

Reference to plate.—The drawing was partly after a figure in Bentley and Trimen's Medicinal Plants, and partly after a specimen in my own herbarium. A, calyx and pistil; B, section of the same; C, a stamen; D, section of ovary; E, transverse section of half-ripe fruit; F, seed; G, section of the same; H, ripe fruit.

The Zamia Palm (*Macrozamia miquelii*, F.v.M.) and its relation to the disease known as Rickets in Cattle.

By F. Turner.

A report has been brought under the notice of the Minister, by Mr. A. Bruce, Chief Inspector of Stock, regarding an interesting experiment recently conducted by Mr. William Norton, of Welton Dale, Yeppoon, Queensland, to determine the effects of the fruit of the zamia palm (*Macrozamia miquelii*) upon cattle eating it. He observed that cattle appeared to become affected with the disease known as "rickets" after feeding upon the fruits of this palm, and in order to arrive at some definite conclusions as to the relations of the plant to this disease, secured a healthy two-year old heifer, which he noticed had eagerly eaten a quantity of male fruits of the Zamia when being driven through a patch of the plants lately scorched by a bush fire. The heifer was shut in a paddock about a ¼ of an acre in extent, well grassed with couch, also containing a good deal of *Sida retusa*; and about 30 to 40 lb. weight of scorched Zamia plants and fruits fed to her daily. She only seemed to take to the food gradually, and no remarkable change could be detected in her condition till the seventh day, when her eyes had a wild look about them, and there appeared to be a twitching of the nerves or muscles all over her. On the thirteenth day she seemed to rally, and appeared in much better health than she had been for several days, feeding more vigorously than before on all parts of the zamia supplied to her. Next day, however, Mr. Norton found that symptoms of undoubted rickets were developed, and he stopped feeding the Zamia. When a representative of the *Daily Northern Argus* saw the heifer on the twenty-first day of the test, the animal appeared hopelessly affected, and showed every symptom of the disease.

As this is a matter of considerable importance to the stock-owners of this Colony, in many parts of which varieties of the Zamia palm are found, the following report on the subject has been prepared, under instructions from the Minister, by the Botanist of the Department, Mr. F. Turner:—

The plant known to botanists as *Macrozamia miquelii*, a quantity of which has been given to an heifer, and is said to have produced rickets in the beast, belongs to the natural order Cycadeæ, under which are arranged in Australia, three genera and about fourteen species, also several varieties. Most of the latter, however, are regarded by a few authorities as species. By far the greater number of these plants are found in the warmer portions of the continent, and principally in Queensland. As far as is at present known there are only four species, and about five varieties found in New South Wales. The species indigenous in this Colony are *Macrozamia paulo-gulielmi*, *M. Denisonii*, *M. miquelii*, and *M. spiralis*. The last-named species is commonly known as the "Burrawang," but in some districts it is

called "Wild Pineapple" from a fanciful resemblance the fruits have to the true pineapple. The "Burrawang" is a very common plant in many places on the eastern side of the Dividing Range from Illawarra to the Tweed. The other three species are found in the northern portion of the Colony.

Although the nuts of some species of *Cycas* and *Macrozamia* at one time formed an important article of food to the aborigines, they appeared to be well aware of their poisonous properties in a raw state, and also of their indigestibility when not carefully prepared. I had abundant proof of this some years ago, when the Queensland Government sent me on a botanical excursion to the Wide Bay District, I had two aborigines with me, and having heard about that time from many sources a great deal about the poisonous properties of the *Macrozamia* fruits, I determined, on the first opportunity, to make a feint to eat one in presence of the blacks, and I thought it would be a good opportunity to prove whether or not the blacks could be relied upon. The *Macrozamia* grew plentifully in the district, and I selected a large and beautiful looking fruit, but no sooner did I attempt to put it near my mouth than both the blacks ran up to me crying out several times, "Baal that fellow," and told me that I would soon die if I eat of it in a raw state. The blacks explained to me how they prepared it as an article of food, which concisely stated, is as follows:—The fruits are composed of a number of nuts, the kernels of which are pounded and put into a dilly-bag, then carried to a stream or water-hole, into which the bag is immersed for about six days, after which the mass in the bag is reduced to the consistency of paste; then it is baked in ashes in a similar way that damper is cooked by white people. Although I have often seen the prepared article, I have never eaten any, but it is said to be very nutritious when carefully prepared and cooked.

Mr. Guthrie, the Chemist of this Department, has obtained the following analysis from the "Burrawang nut":—

Water	48·421
Fat	0·689
Albuminoids	11·536
Starch	28·369
Sugar	3·782
Cellulose	6·546
Ash	0·657

The ash contains calcium, magnesium, potassium, and phosphoric acid.

Analysis of arrowroot made from "Burrawang nut":—

Starch granules	82·475
Water	16·422
Albuminoids	0·437
Ash	0·158
	99·492

The poison in this nut has never been satisfactorily identified. According to an analysis made some time ago and published in the Royal Society's Proceedings for N.S.W., by Dr. Milford, the nut contains oxalic acid and an alkaloid.

The matter is still under investigation in the Departmental laboratory.

Regarding *Macrozamia* fruits, Baron von Mueller, in *Chemist and Druggist*, Melbourne, 1883, says:—"The kernels of the nuts, after being pounded, macerated, and baked, are eaten by the natives. Curiously enough, the original occupants of the soil seem never to have made use of the copious starch which can be readily washed out of the comminuted stems of any *Cycadeous*

plants. All these plants are pervaded by a virulent poison principle, which becomes inert or expelled by heat."

Dr. T. L. Bancroft, who was commissioned by the Queensland Government to investigate the disease in cattle known as "rickets," which has been very prevalent for some years past in the central coast district of Queensland has furnished a report, a summary of which was published in the *Queenslander*, and from which the following is extracted:—"Rickets occurs exclusively upon the coast lands of Queensland and Western Australia. The Zamia (*Macrozamia*) palm grows in these regions, and has been thought by many stock-owners to produce the disease. If it can be shown that the Zamia is the cause, it would be much better to call the disease 'zamia paralysis,' for the name 'rickets' has already been used to designate a very different affection, in which softening of the bones is the main morbid change. A Commission, appointed by the Government of Western Australia in 1890 to report upon this disease, arrived at the conclusions 'that the disease is not climatic, certainly not hereditary, is neither infectious nor contagious, that the beef, when slaughtered, is perfectly healthy as an article of human food, and that the Commission are strongly disposed to think the disease will be traced to some food plant eaten by cattle, a taste for which they only contract under exceptional circumstances.' "

Rickets has been variously said to be identical with rheumatism, anæmia, black-leg, paraplegia, &c., and to be due to in-breeding, to scrub ticks, to amphistoma, to Zamia, grass tree, Poranthera, and several other supposed poisonous plants, but Dr. Bancroft holds with none of these theories, except that which ascribes the disease to the eating of the Zamia palm. The disease has been noticed in the district north of the Fitzroy River for the last twenty years, but lately it has greatly increased, until now the majority of the stations are affected, some few very badly. Indeed, upon two or three, perhaps half of the whole herd is diseased.

Over-stocking on infected runs has increased it, probably by causing the cattle to fall back upon the Zamia for food. Some stations are, and always have been, free from rickets, and the owners of these state that their cattle do not eat Zamia; others were free until some "ricketies" got in, and in this way the disease was introduced. It is a curious circumstance that rickety cattle are all, as far as can be ascertained, addicted to eating Zamia, and one zamia-eater has been known to teach many others the habit.

The chief symptom of the disease is loss of proper control over the movements of the hind limbs. A rickety animal may run several yards without showing any peculiarity whatever, when suddenly it may drag its hind limbs much like a dog sick from tick-bite, or knuckle over upon its hind fetlocks, or may fall upon its haunches, immediately afterwards righting itself. Badly-affected animals, when excited a good deal, may fall quite helpless for a minute or more, after which they get up and walk away as if nothing was amiss with them, and are even able to jump fences. This proves that the affection is not a true paraplegia. Cattle of every description take the disease; but young stock in poor condition are more subject to it. The disease comes on apparently without premonitory symptoms. (Better observations are needed to prove this.) Affected animals seem never to recover completely, the weakness of hind-quarters continuing throughout life; but although their infirmity handicaps them in obtaining food, they are capable of being fattened if placed on good feed, and the flesh of those in good condition appears to be quite sound. All the organs appear normal, but there is often a slight muscular wasting of the hind-quarters, the fat is very yellow and watery, and indeed there is an œdematous state of the whole body.

"The affected district is well watered, and there is nothing to indicate that bad or other poisonous mineral matter is the cause of rickets. There are no poisonous plants peculiar to the Broadsound district, but the Zamia (*Macrozamia miquelii*) is extremely common there. This palm grows as far south as Brisbane, and there is still a good deal of it growing upon the Enoggera Ranges. Rickets has been noticed occasionally in districts around Brisbane, quite recently at Mooloolah, where it was thought to be due to stock feeding upon the wild pine-apple (*Macrozamia spiralis*). It is remarked that the kernels of the Zamia contain no poison. Solutions of them injected into guinea-pigs and frogs had no effect whatever, but when fowls and ducks were given a large quantity of the kernels at one meal death frequently resulted after a day or two from gastro-enteritis, caused by the absolute indigestibility of the material. The blacks who eat the Zamia nuts prepare them by a special process involving a kind of fermentation, which appears to remove the indigestibility. Dr. Bancroft endeavoured to get several calves to eat Zamia, but without success. The two ricketies at the Indooroopilly Quarantine Ground would eat it, but no sound animal could be induced to touch it. To Dr. Bancroft it appears that the fact of the Zamia not containing poison rather strengthens than otherwise the theory of its producing paralysis. All parts of the plant are indigestible, and indigestion is known to set up in bovine animals reflex paraplegia, which is a condition very similar to rickets."

The whole tenor of the report is in favour of the Zamia theory.

Both the species of *Macrozamia* are found in this Colony—one of them very plentifully—that are said to cause rickets in cattle that eat of them. I would therefore beg to suggest that this report be published in the *Agricultural Gazette*, for the information of the stockowners in this Colony.

Book-Keeping for Farmers and Orchardists.

By CHAS. T. MUSSON, F.L.S.,
Hawkesbury Agricultural College.

There is badly wanted amongst farmers and orchardists a simple method of book-keeping, which, without requiring the devotion of a large amount of time or trouble, will, if properly carried out, enable growers to keep in close touch with their affairs, and put them in a position to find out at any time whether they are losing or making money, not only on the whole of their transactions, but also in any one of the lines in which they may be embarked.

It may be tolerably easy at times to obtain good crops of grain or fruit, but of what avail is that if the grower loses money in the transaction. A man can only find out his true commercial position, as to whether he is losing or making money, and the amount of capital invested in his business, by recording all transactions in a set of books, which, although requiring method, care, and accuracy in their compilation, need not entail more work on the, perhaps, already hard-worked orchardist or farmer, than is absolutely essential for such an important purpose.

It has been well said that "bad book-keeping is the highroad to bankruptcy." What, however, should be said in cases (of too frequent occurrence) where *no* books are kept, or perhaps merely a bare statement of expenditure and receipts, entered in some memorandum-book, without even an attempt at arrangement, over which the owner pores for hours without arriving at any satisfactory conclusion as to the meaning of his mass of figures. In such cases it is impossible to find out the true monetary state of affairs, a position in which farmers or orchardists ought not to be, and need not be. An accurate knowledge as to his monetary position should be as important an object to the grower as the state of his crops. Crops are grown for the express purpose of making money, and a thorough acquaintance with the state of our affairs from a commercial point of view is most important in connection with the object in view.

It needs no remarks from me to emphasise further the truths above stated. I will merely add that it appears to be nearly the rule amongst farmers to keep no proper set of books from which a balance sheet could be made out, for instance. It can hardly be doubted that when a man has a thorough grip of his affairs he is able to overlook them better, his relation to them is closer, and he stands a fair chance of succeding in his work; merely because he is able to put his finger at once on any weak spot, curtail expenditure where seen to be excessive, and encourage the development of his more paying lines. Of such points as these he could not avail himself without the necessary materials at hand, in the shape of a well-kept set of books.

It is the object of this article to point out how farm or orchard accounts may be kept in such a way as would enable anyone to find out at any time the true position of his business, and whether the transactions are resulting in profit or loss. The plan here indicated will be carried out in the simplest way possible, consistent with clearness and accuracy of results. The ordinary system of double entry is followed, the books necessary being two in number. It may be noted that the plan to be explained here is sufficient for all ordinary farm and orchard purposes. If the transactions are extensive the same method (double entry) should be followed, but the details as to books and accounts required, would vary according to circumstances. Let us at once proceed to examine the matter in detail. The chief books, as stated, are two in number.

Books.

I. Day-book, also used as a Journal.

Ruled with two sets of money columns to the right of each page, it is, in fact, a journal proper, used as day-book and journal combined. In this book all transactions must be entered; all purchases, sales, receipts, or payments must be entered daily, as they occur; all these entries are to be carefully kept to the left-hand side of a double line, ruled, as shown in the example below, leaving the right-hand side of each page, with the money columns, open. So far, this book is a day-book; it is converted into a journal merely by "journalising" the accounts therein—that is, classifying them, say every week, and entering the amounts in their proper places in the money columns on the journal side of the page. These money columns are headed—the right-hand one Cr., the left-hand one Dr.; the accounts to be entered in the Dr. column (debited) and in the Cr. column (credited) are named in accordance with fact and convenience, as the owner may arrange. The account names are to be entered in the column prepared for same, to left of the money columns, and to right of the dotted line. The arrangement of all accounts in this way is a great convenience, and will be fully explained later. In business, it is usual to have separate books for each of the classes of transactions mentioned above, viz., sales, purchases, cash, journal, &c.; all the entries in these books being classified in the journal, ready to be posted into the ledger, or the journal may be dispensed with, the posting then being done direct from the general books into the ledger. In order to simplify matters, farmers are advised to adopt the plan here set forth, converting their day-book into a journal; a plan easily carried out by using books properly ruled and of a suitable size, as, for instance, foolscap, 8 in. x 13 in.

II. Ledger.

A book in which all the journalised amounts are duly posted under their proper headings. It is, in fact, a condensed and concise statement of all money affairs properly arranged. From it, when correctly posted, a complete statement as to transactions and monetary position can be obtained. Each page is divided into two parts; each of these parts is provided with a money column; the left side of the page is headed Dr. (corresponding with the Dr. column in the journal), the right side is headed Cr. (corresponding with Cr. side of journal).

These two, with petty-cash and cash-books, are all the books really necessary for ordinary farm or orchard accounts. Books ready ruled for journal and ledger can be obtained from any bookseller in the size advised above, from about 8d. each. Several subsidiary books may be used, if so

desired; for instance, all day-book entries might pass first through a memorandum-book. A purchase invoice book is useful. Valuation and labour books should be kept, whilst a Bank-book would be so of necessity. Particulars will be given later dealing with the books here mentioned; for the present we confine our attention to the two main books—day-book journal and ledger.

General Rules.

It would be well now to state the general rules regulating all entries to be observed in journalising the day-book. When journalised, the items are ready for posting (entering) into the ledger. All figures under Dr. column in journal are transferred to the ledger, being entered in Dr. column of the indicated account; all journal credit (Cr.) items are posted to the Cr. column of indicated account in ledger. Great care must be taken that the accounts in the ledger take their proper items, as the arrangement in journalising is the vital principle regulating the proper recording of all transactions. The regulating of the day-book entries, in journalising them, requires some thought; once done correctly, however, it is merely required that strict accuracy be observed in transcribing into the ledger. Full particulars concerning each item must be entered in day-book. In the case of purchases, the invoices received by owner of books should be folded up and pasted in an old book, or otherwise filed for future reference, being numbered for reference and kept in chronological order. All cheques paid away should be numbered, and the number recorded in day-book when entering up details of the payment. In posting the journalised items into ledger no details are given; the entry is made as short as possible, consistent with accuracy, indicating only the kind of transaction, as will be seen in the example given; the ledger entries being merely a condensed and correctly-arranged copy of the journalised items; all figures, of course, being copied in full.

Rules.

The rules regulating the journalising of all transactions entered in day-book may be stated and illustrated as under:—

A. Monetary Transactions.—Cash, notes, cheques, &c. All these affect the money account, which is called Cash or Bank account.

1. *Incoming amounts* are to be entered on the debit side (under Dr.) of the money account; this is called debiting an account; it merely consists of making an entry on the Dr. side. The item is also credited to the payer—that is, entered on the Cr. side of the account headed by name of the party paying the amount (a so-called personal account). The two accounts to be respectively debited and credited are in each case indicated in the journal in space left for the purpose when the day-book entries are made.

Example, with items Journalised.

Day-Book. Journal.

			Ledger page.	*Dr.* £ s. d.	*Cr.* £ s. d.
1892. Feb. 24.	Received cash from B. Davis—£1 10s.	Dr.—Cash account..	....	1 10 0	......
		Cr.—Davis account.	....	......	1 10 0

The amount £1 10s. is debited (Dr.) to Cash, because all money coming in is debited to that account, indicating an addition to money in the Bank

(all such items should be paid into Bank), whilst the item is credited to the personal account (Cr. Davis), showing that Davis has paid the amount named. In posting these items into ledger it is merely necessary to turn up Cash account therein, and enter up on the Dr. side To Davis, £1 10s., recording the journal page in ledger and ledger page in journal, in the spaces left for the purpose; then turn up Davis' account and on the Cr. side, enter By cash £1 10s., recording the page numbers again. The word "To" is always used on the Dr. side, and "By" on the Cr. side.

2. *Outgoing Amounts.*—Payments for anything are to be entered to the credit (on Cr. side) of the money account, all money going out being credited to that account; they are really payments from our ready money, to be debited (Dr.) to the personal account to which the money is paid.

Example, with items Journalised.

DAY BOOK.		JOURNAL.		*Dr.*	*Cr.*
			Ledger page.	£ s. d.	£ s. d.
1892. Jan. 30	Paid to Riverstone Co., my cheque, No. 2, £2 10s.	Dr.—Riverstone account.	....	2 10 0	......
		Cr.—Cash account..	....	......	2 10 0

This amount being paid out of Cash is credited (Cr.) to that account, and debited (Dr.) to the personal account receiving the amount. When posting into the ledger, the items are dealt with as arranged for above, and the page numbers are again recorded,—ledger page in journal, and journal page in ledger. This should be carried out in the case of every entry.

B.—Personal Transactions.

3. *Sales.*—All amounts to be entered to the debit (Dr.) of the purchaser (set down on the debit side of his account), and to the credit (Cr.) of the property account interested, *i.e.*, Stock, Crop, Orchard, &c., as the case may be. Such transactions indicate returns in favour of property, and the property accounts must receive due credit.

Example, with items Journalised.

DAY-BOOK.		JOURNAL.		*Dr.*	*Cr.*
			Ledger page.	£ s. d.	£ s. d.
1892. Feb. 4...	Sold to O. Morris—4 tons O. hay, at £2 15s. per ton—£11.	Dr.—Morris' account.	.....	11 0 0	......
		Cr.—Crop account..	....	......	11 0 0

This being a return in favour of crop, must be credited (Cr.) to that account, and debited (Dr.) to the personal account (person we sell to, in this case Morris). Necessary reference pages are again to be recorded.

4. *Purchases.*—All amounts are to be credited (put on Cr. side) to the personal account interested (the person or firm from whom the purchase is made), and debited (on the Dr. side) to the property account interested: all purchases being really expenses incurred on behalf of some property account.

Example, with items Journalised.

Day-book.		Journal.	Ledger page.	Dr. £ s. d.	Cr. £ s. d.
1892. Jan. 5..	Bought from Lassetter & Co., a plough (one-horse), £4 5s., invoice No. 1.	Dr.—Plant account.	....	4 5 0	......
		Cr.—Lassetter account.	....	......	4 5 0

This being an expense on behalf of Plant, must be debited (Dr.) to that account, and credited (Cr.) to the personal account (Lassetter's), showing that owner of books owes the amount to Lassetter. Pages on which entries are made to be registered as before.

All the foregoing items should be posted into ledger exactly as journalised. It will be seen, on carefully reading through these rules and the explanatory examples attached, that for each transaction two entries in the ledger are necessary—one on the Dr. side and one on the Cr. side—of two different accounts, thus carrying out the principle of double entry, so arranging the items as to be easily understood. In the case of a sale or a purchase, one entry is made in some personal account and the second entry in the interested property account. In the case of money received or paid, one entry goes to a personal account and the second to the money account (Bank or Cash), indicating in the latter case, on the Dr. side all "receipts" of money, and on the Cr. side all "payments." No entry is made unless the transaction is completed, *i.e.*, a sale or a purchase made, a cheque paid or received, &c., each transaction requiring its own proper (two) entries. In journalising, we always exactly indicate the accounts to which the various items are to be posted, together with the amount, so that when items are journalised it is a comparatively easy matter to negotiate the ledger.

The advantages gained by adopting the double entry system of book-keeping are considerable. We can see at a glance in the Cash or Bank account the state of our finances, whether there is money in the Bank (account in credit, *i.e.*, showing a larger amount on the Dr. side than on Cr. side), or, possibly, that we owe money to the Bank (account in debit, the amount being largest on credit side, indicating that we have drawn out more than was put in).

There is also shown in the personal accounts the position of affairs with respect to those persons with whom the owner is doing business (buying or selling); whilst in the property accounts the amounts expended and received are recorded under their proper headings. All these are most desirable things to know, particularly so if the state of affairs can be understood by going through the books at any time. The receipts, added to present value of any particular kind of property under consideration, will tell us, when compared with expenditure, whether money is being made or lost; if the latter, something should be done to improve matters, either by reducing expenditure, enlarging receipts, or even by giving up the particular line. No doubt, seeing this to be the case from our books, we should endeavour to retrieve our loss—extending business in other, paying lines, or striking out into something fresh. Without books it is impossible to obtain such information as is referred to above.

It is easy to see, also, that when we are in a position to pick out any weak spot in our affairs it would be extremely foolish, even criminal, to allow bad to become worse.

The great value of accurate book-keeping is that it enables us to keep all affairs well in hand; we can follow the course of events closely and carefully, acting on the knowledge obtained from the books, with judgment, nursing and extending whatever pays, and putting a stop to non-paying business. No man in his right senses would (or should) continue a thing that is clearly shown not to pay. With books before him giving full particulars as to his affairs, the owner is in a position to make use of them to the best advantage in the ways indicated.

In every way we look at it, a proper system of keeping accounts is most valuable. The plan here set forth records everything, and shows all that can be desired; whilst if such a system of recording all transactions is properly understood and thoroughly carried out, it will answer every purpose.

It is easy to keep the records correctly, and, unless a large number of accounts are opened, very little labour is entailed. Regularity and a methodical system are, however, necessary, or accuracy cannot be attained.

It is highly necessary to explain and illustrate fully the methods employed in opening a set of books, recording all transactions, drawing up a balance-sheet, and finally closing the ledger after a definite period of time, according to the accepted rules regulating book-keeping by double entry. After the preliminary explanations given above, we are in a position to carry this out; and in order to do so, in such a way as will be readily understood, let us take as an example the case of a farmer desiring to keep his books on the model here advised. We will suppose, therefore, that Stephen Williams, renting a farm from 1st January, 1890, having eight years of a lease to run, at a rental of £50 per annum, commences on 1st January, 1891, to keep his books by double entry, in the manner to be set forth below. His first business is to find out the exact amount of his invested capital—that is, the net value of his stock, crop, implements, &c., together with amount of money in hand.

Having gone into the matter carefully (it will be necessary to refer to the subject of valuations again), he arrives at the following results, as giving his monetary position, after payment of all just debts. January 1st, 1891.—Value of stock—Horses, £60; pigs, £5; poultry, £3; total, £68. Crops—growing, £30; stored, £50; total, £80. Implements, £25. Money in Bank, £74—or a net capital of £247 invested in his farm under the various heads mentioned.

Day-book Journal.

These items having been properly entered in the day-book to the left of the double line can be at once journalised. (Two lines are always required in the money columns for this purpose, occasionally more, for each entry). The object of keeping a journal (usually an entirely separate book) is, to furnish a clear statement of all transactions, arranged in such a way as will assist in their transference to the ledger; each entry is complete in itself, and in every case we indicate the particular ledger accounts that are to be debited and credited. The entries need not necessarily be confined to money matters. Particulars as to times when crops were sown or reaped—any remarkable variations in the weather, heavy storms, floods, or droughts, might all be entered as they occur, making the day-book journal a "diary of events," likely to be of great use to the farmer as a work of reference in future years.

Journalising (regulating the day book-entries in such a way as to make them ready for immediate transference to the ledger) should be carried out every week or month, the former preferably. When ready, the journalised items should be posted at once into the ledger.

Let us now proceed to journalise the items set down above, as making up all capital employed in the business. The items can be arranged under two heads—(*a*) Money; (*b*) Property. There are no book-debts (accounts due to owner or owing by him). (*a*) Money in bank, £74. This being a portion of the Capital must be placed to the credit of Capital account—that is, entered on the credit side of that account; it must also be debited to Bank account, entered on debit side, as owed by Bank to the owner of books.

When we have decided how each day-book entry is to be journalised, we proceed to "journalise" the items by making the necessary entries in the journal columns, indicating in each case, in the space provided for the purpose, the name of the ledger account to which the item is to be posted, and the amount. Stock is represented by a total of £68. This, being capital invested in stock, is debited to a "Stock" account, unless it is desired to separate the different kinds of stock, and keep a special account for each. The amount must also be credited to "Capital account," making the necessary entries in "Journal," as directed above. Crop, total value £80, must be treated in the same way, being debited to the property account called "Crop," and credited to "Capital account." Implements, £25, must be debited to a "Plant account," and credited to "Capital account." Stock and other kinds of property are as much capital as money itself; such property, if a means towards production, is only money locked up in certain articles, by means of which the farmer hopes to make a profit. All these items, when properly arranged for posting into the ledger, represent under the head of "Capital," and placed to its credit, a total of £247; showing that owner has that amount invested in his business. The amount is represented by various kinds of property, the value of each being debited under its own proper head. When these amounts have been posted into the ledger it will be found that the same total amount has been entered on each side (Dr. and Cr.); the figures will tally with those of the journal, and the ledger will balance.

These preliminaries satisfactorily arranged (posting into the ledger can be left for a time), we can proceed with the transactions, taking such as are likely to occur during the year; they require to be entered in the day-book (see example given below) in the manner already indicated. Let us take these entries in detail and explain how they are to be arranged on the journal side of the book; in other words, we will "journalise" the transactions, following the rules laid down. When making the day-book entries we must not forget to leave room for the journalising process, two lines in the money column being usually sufficient; but in cases of labour items and wherever "discount" is allowed or obtained, four lines are necessary. All day-book entries should be made on the days the transactions occur; nothing should be left to memory. The entries should give particulars as fully as possible. In the case of sales, a copy of any entry constitutes what is technically known as an invoice, a document that should always be sent to the purchaser on the day the goods are dispatched. These invoices are generally made out on printed billheads, or invoice forms as they are called, and it is advisable to take a copy of same in a letter-press book. In the case of purchases, all invoices received, giving particulars as to the articles purchased, should be arranged according to date, numbered consecutively, and kept for reference, the numbers being in all cases recorded in the day-book entries. In entering cheques paid away the number of cheque should always be registered. These matters, small in themselves, constitute an important item in correct book-keeping, facilitating future reference, and often saving hours of labour. Instead of using one page for both day-book and journal, two

pages can be used if it is so desired, the left-hand side for day-book, the right-hand one for Journal, remembering always to leave one line (or more) between each entry, unless the entry itself takes up two lines.

Taking now the items in order, as set forth in the example given below (the reader is advised to follow them out one by one, as the explanation is given):—

January 5.—A purchase from Lassetter, see page 166.

January 12.—Paid for household stores, cheque £7.—This money going out of cash (rule 2) must be credited to that account (Cr. Cash), and debited to the account for which the expense is incurred (Dr. Expenses). Accounts must be opened in ledger for "Cash" and "Expenses."

January 12.—Bought from Riverstone Co., manure, £2 10s.—This being a purchase (rule 4) must be credited to the personal account interested, namely, the people the purchase is made from (Cr. Riverstone), for whom an account must be opened in ledger, and debited to the account for which the expense is incurred (Dr. Crop). A "Crop" account must be opened.

In the first item for January 12, the entries are made without the intervention of any personal account, being confined to the two accounts "Expenses" and "Cash." In the second item of same date it will require that the paymont for the manure be registered when such takes place, calling for two more entries, as will be seen shortly. In all cases where an account has to be opened it is done in the way below described (see ledger), and need not now be referred to again.

January 30.—Paid Riverstone Co., £2 10s.—According to rule 2 this amount must be debited to the people receiving the money (Dr. Riverstone), and credited to the money account (Cr. Cash), as it goes out of the money in Bank. These two entries complete the Riverstone transaction; it will be seen on referring that four entries have been made—two in the personal account (Riverstone), one in a property account (Crop), and one in the money account (Cash). It is always best to deal with entries in this way rather than by omitting the personal account entries, as is sometimes the case when ready money is paid or received. Both systems are illustrated here, in order better to show the method of journalising.

January 30.—Cheque sent to Lassetter, £4 5s.—This must be dealt with in precisely the same way as the last item. Of course, however, under the proper headings (Dr. Lassetter, and Cr. Cash).

February 4.—Sold to Morris, hay, £11.—According to rule 3 this must be debited to personal account (Dr. side of Morris' account), and credited to the property account interested (Cr. side of Crop account). This is a return on behalf of Crop, and that account must take credit for it. The entry on Dr. side of Morris's account means that Morris owes the owner of books the amount stated.

February 17.—Sold to Davis, stock, £1 10s. (rule 3).—Dr. Davis, and Cr. Stock.

February 24.—Received from Davis, £1 10s.—This being money coming in, according to rule 1, must be debited to the money account (Dr. Cash) and credited to the personal account paying it (Cr. Davis). The entries, when finally made in ledger, will show that Davis has paid the sum stated, having owed it for goods purchased on 17th February.

Items following this last must be dealt with according to the rules given, their method of classification having been fully explained above.

August.—Received from Hopkins, cheque for £52, to be taken in full payment of his account, which is seen, on reference to the ledger, to be £52 10s., he being allowed the 10s. discount.—By rule 1, we must credit the personal account with the amount sent (Cr. Hopkins, £52), and debit the money account with same amount (Dr. Cash, £52). Then, in order to balance Hopkins's account in the ledger, we must give his account credit for the 10s. (Cr. Hopkins, 10s. discount), and debit the same to some so-called nominal account, in order not to disarrange the entries already made in the books. We debit the amount, therefore, to an account opened under the name of "Profit and Loss" (to be more fully explained later). It could, however, be debited to a "Discount" account, with the same result. This amount of 10s. is not money received, but an amount we ought to have received as a part of the sale price for something. The property account interested has taken credit for it along with the £52. This amount, 10s., being an allowance, is looked upon as a loss or an expense, as the readiest way to regulate the matter, thus saving alterations in the books that would otherwise have to be made. If owner obtains any concessions in the way of discount when paying his accounts, the items must be debited to the personal account allowing it, and being looked upon as a gain, should be credited to Profit and Loss account (or Discount Account).

August 30.—Paid for labour, £7 5s. (see page 6, from labour-book, given below).—This amount coming out of Cash, is, by rule 2, credited (Cr.) to Cash, and debited to the property accounts for the benefit of which the money has been expended. In this case, as a careful record has been kept, and a weekly statement made out in the labour-book, it is seen that the amount is to be divided between Crop (£6), Stock (£1), Plant (5s.), which accounts are to be debited (Dr.) with these amounts, meaning that we are charging to the several Property Accounts expenses incurred on their behalf.

August 30.—Food provided for labourers, £1.—Two men are paid £1 a week and rations. These rations, coming out of household stores (Expenses account), and already charged up to that account, must now be charged to the property account, connected with which the men have been working. We therefore debit (Dr.) Crop account with £1, and credit Expenses account with that amount. In this case no money passes; the item, as treated, records the transferring of certain goods (the value being £1) from one account to another, a most important point in the regulation of farm accounts, to be further illustrated below.

November 30.—Two amounts paid for drainage.—They should (rule 2) be credited to cash, and debited to an Improvement account, in order to allow of the equitable division of this expenditure over a series of years (see below for explanation in connection with valuations).

December 31.—Value of farm stock consumed by house, £15.—This is for food supplied by farm to the family. The value represents a portion of the return from the farm, and although no money passes, it is necessary to give stock credit for having supplied the articles to the amount of their sale value (Cr. Stock). An account of such things should always be carefully kept. They might have had to be purchased, in which case money would have been paid out; so the transactions are legitimate expenses on behalf of the household, consequently the amount must be debited (Dr.) to Expenses account. The farm, supplying such saleable commodities, must take credit for same, the transaction being thus recorded correctly.

December 31.—Estimated value of crop used in house, £8. This item must be treated in the same way as the last. Credit is given to Crop account, whilst Expenses account is debited with the amount.

December 31.—Value of crop consumed by farm stock, £20.—This represents produce that might have been sold, the money received would no doubt have been expended on something in connection with the farm, possibly food for the horses. We, in order to properly regulate the accounts, give credit to the Crop account, and charge the amount to Stock (Dr.) In the same way, item December 31, £3 10s., for manure from own stable, used on farm. The manure is marketable; it is therefore valued, and the amount charged to Crop account (Dr. Crop), whilst it is credited (Cr.) to Stock, as being the "producing" property account, and crop the account "consuming" the product. These latter items, illustrating the making use of farm produce on the farm, require careful attention.

Unless the farmer keeps accurate account of the interchanges affecting his various kinds of property it is impossible to arrive at a correct record as to the state of his affairs, and the matter cannot be too strongly impressed upon growers.

It must be noted that we are here dealing with the whole of the entries for one year. Under ordinary circumstances entries would be made in the day-book as the transactions occur. These entries should be journalised and posted into the ledger every week. After every periodical "posting," it will be found advisable to check the correctness of all entries, as a mistake is much more easily put right at the time of making, than if only found out months afterwards.

Below is the "Day-book Journal," with all items in full. It is advised that the reader trace all items through the stage of journalising before coming to the next process, that of posting into the ledger.

Page 1.

DAY-BOOK. ITEMS JOURNALISED.

1891.	Opening entries.	Posted to Ledger Accounts as under—	Ledger page.	*Dr.* £ s. d.	*Cr.* £ s. d.
Jan. 1	I find my property consists of items as follows (*see* folio in Valuation-book):—				
	Money in Bank £74	Dr. Cash	270	74 0 0	
		Cr. Capital	290	......	74 0 0
	Value of Stock.. .. .. .. £68	Dr. Stock	120	68 0 0	
		Cr. Capital	290	......	68 0 0
	" Crops.. .. .. .. £80	Dr. Crop	140	80 0 0	
		Cr. Capital	290	......	80 0 0
	" Plant.. .. .. .. £25	Dr. Plant	160	25 0 0	
		Cr. Capital	290	......	25 0 0
	As under, my transactions for 1891:—				
Jan. 5	Bought from Lassetter, a 1-horse plough (Invoice No. 1), £4 5s.	Dr. Plant	160	4 5 0	
		Cr. Lassetter ..	1	......	4 5 0
" 12	Paid for household stores, my cheque No. 1 (Invoice No 2), £7.	Dr. Expenses ..	200	7 0 0	
		Cr. Cash	270	......	7 0 0
" 12	Bought from Riverstone Co., 5 sacks bone-dust (Invoice 3), £2 10s.	Dr. Crop	140	2 10 0	
		Cr. Riverstone ..	10	......	2 10 0
" 30	Paid Riverstone Co. my cheque No. 2, £2 10s.	Dr. Riverstone ..	10	2 10 0	
		Cr. Cash	270	......	2 10 0
" 30	Sent my cheque No. 3, to Lassetter, £4 5s.	Dr. Lassetter ..	1	4 5 0	
		Cr. Cash	270	......	4 5 0
Feb. 4	Sold to O. Morris, 4 tons O. hay, at £2 15s. per ton, £11.	Dr. Morris	20	11 0 0	
		Cr. Crop	140	......	11 0 0
" 17	Sold to B. Davis, 2 calves, at 15s. each, £1 10s.	Dr. Davis	30	1 10 0	
		Cr. Stock	120	......	1 10 0
" 24	Received cash from B. Davis, £1 10s.	Dr. Cash	270	1 10 0	
		Cr. Davis	30	......	1 10 0
" 28	Received cheque from Morris, £11.	Dr. Cash	270	11 0 0	
		Cr. Morris	20	......	11 0 0
	Carried forward		£	292 10 0	292 10 0

Page 2.

Day-book. **Items Journalised.**

				Dr. £ s. d.	Cr. £ s. d.
	Brought forward	....	....	292 10 0	292 10 0
Mar. 6	Bought from P. Broadbent, 1 iron harrow, and a pair chains (Invoice 4), £3 18s. 6d.	Dr. Plant	160	3 18 6	
		Cr. Broadbent ..	40	......	3 18 6
,, 6	Paid for household stores, cheque No. 4 (Invoice 5), £4 10s.	Dr. Expenses ..	200	4 10 0	
		Cr. Cash	270	......	4 10 0
May 6	Sold 14 pigs (weaners) for cash, at 6s. each, £4 4s.	Dr. Cash	270	4 4 0	
		Cr. Stock	120	......	4 4 0
June 2	Sold to J. Hopkins, 300 bush. maize, at 3s. 6d. per b., £52 10s.	Dr. Hopkins ..	50	52 10 0	
		Cr. Crop	140	......	52 10 0
,, 7	Bought from W. Robinson, a cow, £5 (Invoice 6).	Dr. Stock	120	5 0 0	
		Cr. Robinson ..	60	......	5 0 0
,, 12	Paid W. Robinson, £5, cheque No. 5.	Dr. Robinson ..	60	5 0 0	
		Cr. Cash	270	......	5 0 0
,, 15	Bought from Anderson, seeds, £2 (Invoice 7).	Dr. Crop	140	2 0 0	
		Cr. Anderson ..	70	......	2 0 0
July 7	Sent Anderson, cheque No. 6, £2.	Dr. Anderson ..	70	2 0 0	
		Cr. Cash	270	......	2 0 0
,, 7	Drew from Bank, £5, cheque No. 7, for petty cash.	Dr. Expenses ..	200	5 0 0	
		Cr. Cash	270	......	5 0 0
Aug. 5	Bought 200 packing-cases, 6d. each (Invoice 8), paid cheque, 8, £5.	Dr. Crop	140	5 0 0	
		Cr. Cash	270	......	5 0 0
,, 5	Received from Hopkins, cheque for £52, allowing him 10s. discount.	Dr. Cash	270	52 0 0	
		Cr. Hopkins ..	50	......	52 0 0
		Dr. Profit and Loss	240	0 10 0	
		Cr. Hopkins ..	50		0 10 0
,, 30	Sold to Davidson & Co., 198 cases oranges, at 3s. 6d. each, £34 13s.	Dr. Davidson ..	80	34 13 0	
		Cr. Crop	140	......	34 13 0
,, 30	Paid for labour, £7 5s. (cheque 9). See Labour Book, p. 6.	Dr. Crop	140	6 0 0	
		Dr. Stock	120	1 0 0	
		Dr. Plant	160	0 5 0	
		Cr. Cash	270	......	7 5 0
	Carried forward..			£476 0 6	476 0 6

Page 3.

Day-book. **Items Journalised.**

				Dr. £ s. d.	Cr. £ s. d.
	Brought forward	....	....	476 0 6	476 0 6
Aug. 30	Food provided for labourers—2 men for 1 week (at 10s. each), £1.	Dr. Crop	140	1 0 0	
		Cr. Expenses ..	200	....	1 0 0
Sept. 7	Received to-day, for butter and eggs sold during last six months, £19 12s. 0d.	Dr. Cash	270	19 12 0	
		Cr. Stock	120	....	19 12 0
,, 7	Paid for household stores, cheque 10 (Invoice No. 9), £14 15s. 0d.	Dr. Expenses ..	200	14 15 0	
		Cr. Cash	270	......	14 15 0
,, 14	Paid blacksmith, mending implements (Invoice 10), cheque 11, £2 0s. 0d.	Dr. Plant	160	2 0 0	
		Cr. Cash	270	......	2 0 0
Oct. 10	Sold to Davidson, 4 tons oaten hay, at £3 5s. per ton, £13 0s. 0d.	Dr. Davidson ..	80	13 0 0	
		Cr. Crop	140	......	13 0 0
Nov. 17	Paid for household expenses, cheque 12 (Invoice 11), £7 0s. 0d.	Dr. Expenses ..	200	7 0 0	
		Cr. Cash	270	......	7 0 0
,, 30	Paid for draining—labour (contract), £18 0s. 0d., cheque 13,	Dr. Improvements..	180	18 0 0	
		Cr. Cash	270	......	18 0 0
,, 30	Paid for draining—materials (Invoice 12), cheque 14, £6.	Dr. Improvements..	180	6 0 0	
		Cr. Cash	270	......	6 0 0
Dec. 31	Butter and eggs sold during last three months, £6 15s. 0d.	Dr. Cash	270	4 15 0	
		Cr. Stock	120	......	4 15 0
,, 31	Estimated value of "stock" used in house during year — bacon, calf, poultry, &c., £15.	Dr Expenses ..	200	15 0 0	
		Cr. Stock	120	......	15 0 0
	Estimated value of "crop" used in house during year—garden and orchard produce, £8 0s. 0d.	Dr. Expenses ..	200	8 0 0	
		Cr. Crop	120	......	8 0 0
	Estimated value of "crop" consumed by stock, £20 0s. 0d.	Dr. Stock	120	20 0 0	
		Cr. Crop	140	......	20 0 0
	Rent paid this day, cheque 15, for the year 1891.	Dr. Rent	260	50 0 0	
		Cr. Cash	270	......	50 0 0
	Used on farm—stable-manure from own stables, estimated at £3 10s. 0d.	Dr. Crop	140	3 10 0	
		Cr. Stock	120	......	3 10 0
	.. .. ..	..		£658 12 6	658 12 6

Ledger.

Having now sufficiently explained the method of journalising all day-book transactions, let us suppose the journal to have been fully entered up, and the totals of Dr. and Cr. columns taken. As they are found to agree, we can next proceed to consider the method of "posting" or entering these journalised items in the ledger. The ledger is really a condensed and tabulated statement of the journal entries, so arranged as to furnish all information necessary for the understanding of the farm affairs. In it all the isolated transactions are collected under proper headings. The number of accounts, each with its own special name, will depend on the amount of business done and on the farmer's system of classification.

Accounts must be opened as required. Opening an account means setting apart a space in the ledger, with the requisite name written at top of page, under which all items proper to such account are to be entered on their appropriate sides. Every account should have a page or more to itself. It is a good plan to arrange in the ledger the position of the various accounts before commencing to post. In a ledger of 300 pages (the supposed number in the example given below) the personal accounts may, for convenience, be all kept together, *i.e.*, in one part of the book, say, the first 150 pages; property accounts, Stock, Crop, Plant, &c., following; Capital, Cash, Profit and Loss, and Balance accounts completing the series. Allowance must be made in every case of such space as shall be deemed advisable, thus making provision for the extension of each account, and allowing for convenient arrangement. "Stock" may, if so desired, be separated under various headings, such as horse, cattle, sheep, pigs, poultry, and bee accounts. Crop might also be subdivided, if considered necessary. For purely orchard purposes an Orchard account might take the place of all Stock and Crop accounts; "Plant" and "Improvements" would, however, need to be kept as separate accounts. Each account should be opened as indicated in the following example; which represents the ledger as just completed, by there having been posted into it all the items from preceding journal example. Every entry must be made in the ledger exactly as classified in the journal, all Dr. items to the Dr. side, and all Cr. items to the Cr. side, of their proper accounts. Not until the items have been so posted has the system of double entry been properly carried out, the process of journalising being merely the preparatory work. The ledger is the most important book, all others merely leading up to it, being used as aids in properly recording and arranging items for entry therein. The journal page must be entered against each entry in ledger as made, and the ledger page must be recorded against the corresponding journal entry, thus allowing facilities for easy reference should occasion for such arise, a matter that frequently happens. In posting accounts from the journal into ledger, details are not given; they are recorded in day-book, and are not again required.

On the Dr. side all entries are prefixed by the word "To"; on the Cr. side the word "By" is always used in the same connection, a clue to the class of transaction being always added in the use of some word as an indicator; as, for instance, cash when referring to cash account, name of personal account, or that of the property account interested (*see* example), everything being recorded in the shortest way possible, consistent with clearness.

If the accounts opened in ledger called personal property or nominal accounts are carefully considered, it will be seen that, in the case of personal accounts, on the Dr. side the items entered may mean either "goods sold" or "money paid" (outgoings) by owner of books. On the Cr. side the items may represent either "money received" or "goods bought" (incomings) by owner of books.

In the property accounts, Dr. items mean "expenses incurred," and Cr. items mean "receipts" or returns in favour of the account. In the cash account Dr. means actual cash received into the business, and if our arrangements are good it may mean money paid into Bank. If such is the case the account might be called "Bank Account," while the Cr. items represent outgoing amounts—money withdrawn from Bank for purpose of making payments.

Each purchase or sale, therefore, necessitates four entries in order to complete the transaction—the first two being made when the transaction is set on foot (personal and property accounts), the last two when the money changes hands (personal and cash accounts); but, as before mentioned, when ready money is paid or received there is no absolute necessity for any entry in a personal account—the transaction may be confined in the ledger and journal entries to property and cash accounts. It is advised, however, that all transactions be treated in full, as though on credit, and entries made accordingly. In connection with "Cash," if the accounts of a farm are numerous, necessitating frequent entries in the money account, it is advised that a separate "Cash-book" be used, writing up all amounts received on the left-hand page, called Dr.; and as these amounts are paid into the Bank, giving credit for them on the right-hand page, called Cr., the book would give an account of all moneys received on Dr. side, and all moneys paid into Bank on Cr. side. Petty-cash payments should be dealt with in a separate book, and balanced up at regular intervals. All money received should be deposited in Bank, and cheques drawn for any amounts required for petty-cash, household expenses, and payments of all kinds. If this plan is strictly followed out, the cheque-book and petty-cash book give records of all disbursements, and it will be an easy matter to keep all cash accounts in order.

Every class of transaction likely to occur in farming and orchard business is here illustrated, except in case of goods sold on commission, and bills given or received instead of money. In the former case, when sending consignments of produce or stock away for sale, it is advisable to enter all particulars respecting quantity, how packed, sent, &c., in a book set apart for such "Adventure" accounts, or even in day-book direct. When the return is to hand it should be entered in day-book in full, journalising the gross amount of sale, gross expenses, and also the net amount received, crediting gross amount of sale to the property account, and debiting it to adventure account; the total expenses being debited to the property account and credited to adventure account. The net amount of money received is debited to money account and credited to adventure account, the profit or loss on the transaction showing itself in the property account totals at end of year. These adventures may be numbered consecutively, and dealt with under their numbers in posting. Below is an example:—

DAY-BOOK. ITEMS JOURNALISED.

	No. 1.		Ledger Account—	Ledger page.	Dr. £ s. d.	Cr. £ s. d.
1892. Feb. 10	Sent to Inglis & Co., for sale, 1 truck pumpkins—4 tons 5 cwt.*	£ s. d.				
17	Received Account Sales for the above 4 tons 5 cwt., at £1 10s.	6 7 6	Dr.—Adventure ..	....	6 7 6	......
			Cr.—Crop ..	....	......	6 7 6
	Trainage, cartage, commission, &c.	1 2 6	Dr.—Crop ..	....	1 2 6	......
			Cr.—Adventure ..	....	......	1 2 6
	Net return	£5 5 0	Dr.—Cash ..	....	5 5 0	......
			Cr.—Adventure ..	....	......	5 5
	Their cheque received for this amount.					

* If entry is made direct into day-book, six lines should be left for the journalising process.

In the case of "bills," if owner of books receives one, after endorsing it (accepting it by signing his name on it) he credits personal account (the giver) with the amount, and debits a "Bills receivable" account: when the bill is met, that is withdrawn, the drawer paying it off, the Bills receivable account is credited, and cash account is debited (bills merely provide a means by which payment may be deferred, and are given upon consent). If owner of books gives a bill, he debits the personal account, and credits the amount to a "Bills payable" account; and when the bill is met, that is to say paid off, he debits the Bills payable account, and credits his money account. Separate Bill Books should be kept if bills are largely resorted to.

The amount represented by bill never appears in the money account until the money is actually received or paid; this only occurs when the bill has been "retired," that is, paid off—exchanged for money. Example:—Owner gives Lassetter a three months' bill, dated 1st February, 1892, for £75. This is placed to the Dr. of Lassetter's account, and to the Cr. of a "Bills payable" account; on 4th May, when the bill becomes due (three days' grace being allowed), the payment of the money having been previously arranged for by cheque or otherwise, entry is made in the day-book stating the fact, and should be dealt with as follows:—Bills payable account is debited, and Cash credited with the amount. The reason for this proceeding is as follows:—The money not being paid out of cash until 4th May is not credited to that account until the money is really used, whilst the handing over of a bill is considered as payment, in the personal account; duly accepted, it is a document exchangeable for money. If the holder desires to realise at once, he can sell it for its face value, less a regular recognised market rate of discount, the amount of such discount being of course to some extent controlled by the state of the money market, and the good name (commercially) of the drawer, or person engaging to pay. (If date of payment falls on a Sunday, it must be "met" the previous Saturday).

Now, in order for the reader to familiarise himself with the plan on which this specimen set of accounts has been worked out (the system of double entry applied to farm accounts), the ledger is given below in full, posted direct from the journalised items in the order in which the supposed transactions occurred. For the present, however, the "closing entries" (given in thick black type) are not to be considered as forming part of the ledger; they must be left out of consideration until the balances are extracted.

It should be noted that rent and rates may be equitably divided between the different property accounts, or kept in a separate account, as is the case in Williams's accounts here given. In opening a set of books it is important that the property accounts required should be clearly planned out, care being taken to decide, before commencing to post into the ledger, the limits of each account, and the matters to be included within each. In connection with money matters, it simplifies things considerably if all money received is paid into Bank, drawing out of Bank all amounts required by cheque. The cheque-book should be gone through at short intervals, in order to see that all payments have been duly recorded in day-book. Bank-book should also be carefully examined at short intervals, in order that everything may be kept thoroughly checked, and the books rendered free from error.

LEDGER.

Date	*Dr.*	Journal Folio.	£ s. d.	Date	*Cr.*	Journal Folio.	£ s. d.
			LASSETTER & CO.		Page 1.		
1891. Jan. 30	To cheque	1	4 5 0	Jan. 5	By plant	1	4 5 0
			RIVERSTONE CO.		Page 10.		
Jan. 12	To cheque	1	2 10 0	Jan. 10	By manure	1	2 10 0
			O. MORRIS.		Page 20.		
1891. Feb. 4	To crop	1	11 0 0	Feb. 20	By cheque	1	11 0 0
			B. DAVIS.		Page 30.		
1891. Feb. 17	To stock	1	1 10 0	Feb. 24	By cash	1	1 10 0
			P. BROADBENT.		Page 40.		
1891. Dec. 31	**To balance**	4	**3 18 6**	Mar. 6	By plant..	2	3 18 6
			J. HOPKINS.		Page 50.		
1891. June 2	To maize	2	52 10 0	Aug. 10	By cheque	2	52 0 0
					,, discount	2	0 10 0
			52 10 0				52 10 0
			W. ROBINSON.		Page 60.		
1891. June 12	To cheque	2	5 0 0	June 7	By stock	2	5 0 0
			ANDERSON & Co.		Page 70.		
1891. July 7	To cheque	2	2 0 0	June 15	By crop	2	2 0 0
			DAVIDSON.		Page 80.		
1891. Aug. 30	To crop	2	34 13 0				
Oct. 10	,, ...	3	13 0 0	**Dec. 31**	**By balance**	4	**47 13 0**
			47 13 0				47 13 0
			STOCK ACCOUNT.		Page 120.		
1891. Jan. 1	To value of stock. (See Valuation-book) ..	1	68 0 0	Feb. 17	By B. Davis	1	1 10 0
June 7	To Robinson	2	5 0 0	May 6	,, cash sale	2	4 4 0
Aug. 30	,, labour—cash ..	2	1 0 0	Sept. 7	,, ,, ...	3	19 12 0
	,, crop	3	20 0 0	Dec. 31	,, ,, ...	3	4 15 0
Dec. 31	,, **profit and loss** ...	4	**41 11 0**	,, 31	,, expenses	3	15 0 0
				,, 31	,, crop	3	3 10 0
				,, **31**	,, **valuations**... ...	4	**87 0 0**
			135 11 0				135 11 0
			CROP ACCOUNT.		Page 140.		
1891. Jan 1	To value of crop ..	1	80 0 0	Feb. 4	By Morris	1	11 0 0
,, 12	,, manure	1	2 10 0	June 2	,, Hopkins	2	52 10 0
June 15	,, Anderson	2	2 0 0	Aug. 30	,, Davidson	2	34 13 0
Aug. 5	,, cash—packing-cases.	2	5 0 0	Oct. 10	,, ,, ...	3	13 0 0
,, 30	,, cash—labour ..	2	6 0 0	Dec. 31	,, expenses	3	8 0 0
,, 30	,, expenses	3	1 0 0	,, 31	,, stock	3	20 0 0
Dec. 31	,, stock—manure ..	3	3 10 0	,, **31**	,, **valuations**... ...	4	**70 0 0**
,, **31**	,, **profit and loss** ...	4	**109 3 0**				
			209 3 0				209 3 0
			PLANT ACCOUNT.		Page 160.		
1891. Jan. 1	To valuations	1	25 0 0	**Dec. 31**	**By valuations** ...	4	**30 0 0**
,, 5	,, Lassetter	1	4 5 0		,, **depreciation—profit & loss.**	4	**5 8 6**
Mar. 6	,, Broadbent	2	3 18 6				
Aug. 30	,, cash—labour ..	2	0 5 0				
Sept. 7	,, ,, repairs ..	3	2 0 0				
			35 8 6				35 8 6

Ledger.

Dr. *Cr.*

UNEXHAUSTED IMPROVEMENTS. Page 180.

1891.		Journal Folio.				Journal Folio.	
Nov. 30	To cash—labour ..	3	18 0 0	Dec. 31	By valuations ...	4	21 0 0
	" material ..	3	6 0 0	" 31	" depreciation—profit & loss	4	3 0 0
			24 0 0				24 0 0

EXPENSES ACCOUNT. Page 200.

1891.							
Jan. 12	To household stores ..	1	7 0 0	Aug. 30	By crop account ..	3	1 0 0
Mar. 6	" ..	2	4 10 0	Dec. 31	" profit and loss ...	4	60 5 0
July 7	" ..	2	5 0 0				
Sept. 7	" ..	3	14 15 0				
Nov. 28	" ..	3	7 0 0				
Dec. 31	" stock ..	3	15 0 0				
" 31	" crop ..	3	8 0 0				
			61 5 0				61 5 0

PROFIT & LOSS ACCOUNT. Page 240.

1891.	Loss.				Gain.		
Aug. 5	Discount, Hopkins ..	2	0 10 0	Dec. 31	By stock	4	41 11 0
Dec. 31	To plant	4	5 8 6	" 31	" crop	4	109 3 0
" 31	" improvements ...	4	3 0 0				
" 31	" rent	4	50 0 0				
" 31	" expenses	7	60 5 0				
" 31	" net gain	4	31 10 6				
			150 14 0				150 14 0

RENT ACCOUNT. Page 260.

1891.							
Dec. 31	To paid cash	3	50 0 0	Dec. 31	By profit and loss ...	4	50 0 0

CASH ACCOUNT. Page 270.

1891.							
Jan. 1	To balance in Bank ..	1	74 0 0	Jan. 12	By expenses	1	7 0 0
Feb. 24	" B. Davis	2	1 10 0	" 12	" Riverstone Co. ..	1	2 10 0
" 30	" O. Morris	2	11 0 0	" 30	" Lassetter	1	4 5 0
May 6	" stock sale	2	4 4 0	Mar. 6	" expenses	2	4 10 0
Aug. 5	" Hopkins	2	52 0 0	June 12	" Robinson	2	5 0 0
" 30	" stock sale	3	19 12 0	July 7	" Anderson	2	2 0 0
Dec. 31	" " "	3	4 15 0	" 7	" expenses	2	5 0 0
				Aug. 5	" crop	2	5 0 0
				" 30	" labour	2	7 5 0
				Sept. 7	" expenses	3	14 15 0
				" 7	" plant	3	2 0 0
				Nov. 28	" expenses	3	7 0 0
				" 30	" improvements ..	3	18 0 0
				" 30	" "	3	6 0 0
				" 31	" rent	3	50 0 0
				" 31	" balance	4	26 16 0
			167 1 0				167 1 0

CAPITAL ACCOUNT. Page 290.

1891.							
Dec. 31	To balance	4	247 0 0	Jan. 1	By cash	1	74 0 0
				" 1	" stock	1	68 0 0
				" 1	" crop	1	80 0 0
				" 1	" plant	1	25 0 0
			247 0 0				247 0 0

BALANCE ACCOUNT. Page 295.

1891.							
Dec. 31	To Davidson	4	47 13 0	Dec. 31	By Broadbent ...	4	3 18 6
" 31	" valuations... ...	4	208 0 0	" 31	" capital	4	247 0 0
" 31	" cash	4	26 16 0	" 31	" net gain	4	31 10 6
			282 9 0				282 9 0

All the journal items having been duly posted in ledger, we can now turn our attention to a most important matter, namely, extracting from the mass of information entered in books the necessary particulars for furnishing a balance-sheet. We must remember that the object of book-keeping is to be able, at any time, with tolerable ease, to find out the monetary position of a business, and see if profit is being made or money lost. To obtain this result, three things are required.—First: A record of all debts owing to owner or due by him. Secondly: An account of all money in hand, if any. Thirdly: A careful valuation of all property: these requirements to be now considered. The first and second requisites we can obtain at once from the ledger, and in order the more easily to do this the ledger balances should be extracted. A list of all accounts in the ledger must be made, and two series of money columns prepared, ruled as in ledger or journal, preferably as in example shown below. That on the left corresponds to Dr. side of ledger; that on the right to the Cr. side of ledger. Taking now the totals of all ledger accounts separately, we place them in proper position, to their own account in the so-called trial balance. All ledger credit totals are placed on the Cr. side, and all debit totals on the Dr. side, taking care that each account receives its proper totals. The two columns of figures are then added up. If the totals correspond, and are also found to correspond with the journal totals, the double entry has been properly carried out, and we may take it that the ledger has been correctly posted. This constitutes the taking out of the trial balance. Many of the accounts will not agree in their Dr. and Cr. totals. It will be necessary to consider these accounts in detail, in order to obtain the requisites for trial balance as explained above. Should the totals of Dr. and Cr. columns in trial balance not agree, the error must be looked for until found, and the necessary corrections made. Unless the books are perfectly correct, a true statement of affairs cannot be arrived at.

TRIAL BALANCE.

December 31, 1891.

Dr. £ s. d.		Accounts.	Ledger folio.	*Cr.* £ s. d.
4 5 0	P	Lassetter	1	4 5 0
2 10 0	P	Riverstone Co.	10	2 10 0
11 0 0	P	Morris	20	11 0 0
1 10 0	P	Davis	30	1 10 0
....	P	Broadbent	40	3 18 6
52 10 0	P	Hopkins	50	52 10 0
5 0 0	P	Robinson	60	5 0 0
2 0 0	P	Anderson	70	2 0 0
47 13 0	P	Davidson	80	....
94 0 0	Py	Stock	120	48 11 0
100 0 0	Py	Crop	140	139 3 0
35 8 6	Py	Plant	160	....
24 0 0	Py	Improvements	180	....
61 5 0	N	Expenses	200	1 0 0
0 10 0	N	Profit and Loss	240	....
50 0 0	N	Rent	260	....
167 1 0	Py	Cash	270	140 5 0
....	N	Capital	290	247 0 0
£658 12 6				£658 12 6

The accounts represented in trial balance (given above) are "Personal," P.; "Property," Py.; and "Nominal," N. From the personal accounts (the balance gives summary only) we can find out all debts due *to* or *by* the

owner of books. Lassetter, Riverstone, Morris, Davis; all these accounts balance, nothing owing on either side.

Broadbent, Cr. £3 18s. 6d. This means (refer to journal) that owner owes to Broadbent the amount named; it is therefore a "liability."

Hopkins, Robinson, Anderson; these accounts all balance. Davidson, according to ledger, is Dr. £47 13s. He owes owner of books that amount. This, therefore, is an asset, and concludes the personal accounts. The only book debt, therefore, is this one, whilst owner owes one small amount—Broadbent, £3 18s. 6d.

Stock, Crop, Plant, and Improvements are Property accounts, to be considered under valuations presently, the amounts set down under Dr. meaning, as before explained, expenses; amounts under Cr. meaning receipts. At present we only require debts and money in hand. The former are found; to find the latter we turn to cash account. Dr. total £167 1s. means money received into business and placed in Bank. Cr. £140 5s. means money paid out of what has been placed in Bank; therefore, there still remains in the Bank, to the credit of owner of books, £26 16s. Expenses, Profit and Loss, Rent, and Capital, are nominal accounts that for our present purpose need no consideration; they tell the amounts expended or received, &c., under each head, and are extremely useful, as will be seen presently in explaining how the money received, has been spent. The only thing now needful for construction of a balance-sheet is a proper valuation of all property. Below is a copy of valuations made for the purpose required, giving a total of £208. It is a good plan to keep some book in which all such records can be permanently written. As this is a matter to be referred to again (see valuations, later), and we have now all the necessary items, we will at once construct the balance-sheet. Take a sheet of paper, ruled precisely the same as a page in the ledger. We head the left-hand column "Liabilities," and the right-hand column "Assets." Under the first head we put down all debts due by owner; in this case one item only—Broadbent, £3 18s. 6d.. Under assets we enter particulars as to—(1) All money due to owner. (2) All money in hand or in the Bank. To these must be added—(3) The amount at which all his property is valued. Here we have a full statement—all we are seeking for—of all the owner's property or *capital*, whether money in hand, money due to him, or money invested in stock or other property. Deducting all liabilities from the gross value of his assets we arrive at the net amount of capital in the business under consideration; represented, as already stated, by cash, book debts, and property—the two former extracted from the books, the latter arrived at by simply valuing all his property, including stock, crop, &c., at a given date.

It may be necessary at times to make some special arrangements in connection with balance-sheet. For instance, owner may be working with borrowed capital, in which case interest on the amount of such capital employed must be charged to the debit of Profit and Loss account, thereby becoming a liability, causing the balance to be reduced by the amount of the interest; or an interest charge may be made by owner on the amount of capital employed; this also goes down as an expense for the year, but such would not be necessary for a farmer dependent upon his yearly gain for a living; the gain would no doubt be mostly, if not all, spent on household and farm expenses.

The balance-sheet shows, therefore, the actual state of Williams's affairs. It does not show how he made and spent the money, but it *does* show the actual amount of money he has invested in his business at a given date. A

full statement as to the amount of gain and of expense during the period of time under review, together with full particulars as to how the money made has been expended, is obtained from the profit and loss account when it is fully made up. How this is done will be seen presently in the process of closing the ledger.

BALANCE-SHEET.

Dr. *Cr.*

1891.	Liabilities.		£ s. d.	1891.	Assets.		£ s. d.
Dec. 31	To Broadbent	....	3 18 6	Dec. 31	By balance in Bank ..	....	26 16 0
					„ book debts, Davidson	....	47 13 0
					„ valuations. „ stock .. £87 „ crop .. 70 „ plant .. 30 „ improvement 21	....	208 0 0
	Balance in my favour, being net amount of my capital, represented by cash, book debts and property.	See page 295, ledger	278 10 6				
		£	282 9 0			£	282 9 0

Having obtained the balance-sheet, it is now necessary to "close the ledger," and arrange what entries require to be made in opening it for the succeeding year (1892). This cannot be properly carried out until the amount of net gain or loss has been found; we have it in the difference between net capital of January 1st, 1891, and that of December 31st, 1891.

In closing the ledger we first give the property accounts credit for the amounts as given in the valuation-book, and used in the balance-sheet, the total, £208, being divided between—Stock, £87; Crop, £70; Plant, £30; Improvements, £21. These amounts having been credited to the various property accounts, the total amount should be debited to a nominal account opened for the purpose, and called "Balance account," really a copy of the balance-sheet, showing, however, on Dr. side, instead of the net capital at end of year, £278 10s. 6d., the two items—Capital, January 1st, 1891, £247; net gain during year, £31 10s. 6d.; otherwise the two, balance account and balance-sheet, tally exactly. These entries may be made first in the ledger, and a copy taken in the day-book, all items to be journalised as posted; the page in journal containing these and the following entries to be headed "Finishing entries." These always come at the end of the yearly transactions, and should be entered up immediately the balance-sheet is satisfactorily worked out. This proceeding, the closing of the ledger, is not absolutely necessary, but for the books to be precise, neat, and presentable, the ledger should be properly closed. Now, let us take the other necessary items and record them. Wherever there is not the same total amount entered on both sides of the ledger, the amount necessary to make the two sides even, or "the balance" is to be filled in, and a copy of the entry taken in journal. The double-entry system must be carried out in connection with these closing entries precisely as in the case of the year's transactions. Having made an entry in order to close an account, or make it balance, the same amount must be inserted in some other account on the other side, so as to make a Dr. and a Cr. entry for each amount. Referring to the ledger, we find Broadbent's account requires an entry of £3 18s. 6d. on the Dr. side

to close it; this item must be entered also on the Cr. side of "Balance account." In the former case we write, To balance, in connection with the entry; in the latter case, "By Broadbent"; this is copied into the journal, in full, with all necessary particulars. A rule may be here stated as to regulation of the second entry in closing the ledger: two accounts only, will take all the items, viz., "Balance," and "Profit and Loss." The latter will take all items directly classified as expenses or gains; the former takes all items found in balance-sheet (refer back for explanation *re* net gain for the year). As the first entries are made in ledger, they can be copied in journal, and a line left for indicating the second account to which item is to be posted. The posting to the two accounts named in rule above, may be deferred until all ledger accounts are closed, save these two.

Davidson's Account requires an entry on Cr. side of £47 13s., the entry is made, by balance, £47 13s., and a record taken in journal; the second entry will be in Balance account, Dr. to Davidson, £47 13s.

Stock Account requires an entry of £41 11s. on the Dr. side. This is net gain on stock for the year. The closing entry will be, To balance, £41 11s. The second entry is to be on Cr. side of Profit and Loss account (*see* rule above), By stock, £49 11s.

Crop Account.—Finishing entry, on Dr. side, To balance, £109 3s.; second entry, Cr. Profit and Loss account, By crop, £109 3s. This is gain on Crop during the year.

Plant Account.—Finishing entry, credit Plant with, By balance, £5 8s. 6d. This is depreciation, and the second entry will be Dr. Profit and Loss account, To plant, £5 8s. 6d.

Rent Account.—We balance ledger by crediting the account with £50. By balance. Second entry will be in Profit and Loss account on Dr. side. It is an expense. To rent, £50.

Capital Account.—Finishing entry is on Dr. side. To balance, £247. Second entry will be in Balance account on Cr. side. By capital, £247.

Cash Account.—Finishing entry is on Cr. side. By balance, £26 16s. Second entry is in Balance account on Dr. side. To cash, £26 16s. Expenses account must be treated exactly same as rent, the second entry going to Dr. of Profit and Loss account.

This done, it only remains to see that all items have been correctly copied into the journal, and that all the necessary items to complete the double entries are correctly posted into the "Profit and Loss" and "Balance" accounts. It will then be found that Profit and Loss account requires an item of £31 10s. 6d. on the Dr. side to balance it, whilst Balance account requires the same amount on the Cr. side in order for it to balance. This amount is the net gain for the year—the amount of profit remaining unexpended; it is the difference between the net capitals of January, 1891, and December, 1891. This will require to be entered. These two entries of the net gain made, and a copy taken in journal, the ledger is closed. All accounts balance, and can be ruled off. A copy of the Profit and Loss account can be made out under name of Profit and Loss sheet if so desired, showing amount of profit made in the various property accounts, and the amounts disbursed in expenses on the different accounts: a most valuable record. The property accounts tell their own story on inspection, as to whether they are paying or not. Below are the "finishing entries" fully journalised.

Page 4.

Day-book. **Items Journalised.**

	Finishing Entries.	Account Posted.	Ledger Folio.	£ s. d.	£ s. d.
1891. Dec. 31	Value of stock, &c., this day	Dr.—Balance ..	295	208 0 0	......
		Cr.—Stock	120	......	87 0 0
		Cr.—Crop	140	......	70 0 0
		Cr.—Plant	160	......	30 0 0
		Cr.—Improvements	180	......	21 0 0
	P. Broadbent	Dr.—Broadbent ..	40	3 18 6	......
		Cr.—Balance ..	295	......	3 18 6
	Davidson	Dr.—Balance ..	295	47 13 0	......
		Cr.—Davidson ..	80	......	47 13 0
	Stock	Dr.—Stock	120	41 11 0	......
		Cr.—Profit and Loss	240	......	41 11 0
	Crop	Dr.—Crop	140	109 3 0	......
		Cr.—Profit and Loss	240	......	109 3 0
	Plant	Dr.—Profit and Loss	240	5 8 6	......
		Cr.—Plant	160	......	5 8 6
	Improvements	Dr.—Profit and Loss	240	3 0 0	......
		Cr.—Improvements	180	......	3 0 0
	Rent	Dr.—Profit and Loss	240	50 0 0	......
		Cr.—Rent	260	......	50 0 0
	Capital	Dr.—Capital ..	290	247 0 0	......
		Cr.—Balance ..	295	......	247 0 0
	Cash	Dr.—Balance ..	295	26 16 0	......
		Cr.—Cash	270	......	26 16 0
	Expenses	Dr.—Profit and Loss	240	60 5 0	......
		Cr.—Expenses ..	200	......	60 5 0
	Net gain	Dr.—Profit and Loss	240	31 10 6	......
		Cr.—Balance ..	295	......	31 10 6
	Total amount, finishing entries	....	£	334 5 6	334 5 6

The books being satisfactorily balanced, and properly closed, nominally on December 31, 1891, possibly not until some days later, Williams opens his day-book journal on January 1, 1892, with the following entries, shown below properly journalised, and ready for posting into ledger.

The items are taken from his balance-sheet, and show at a glance exactly how on the date given, his capital is invested.

Page 5.

Day-book. **Items Journalised.**

		Posted to ledger accounts as under.	Ledger page.	*Dr.* £ s. d.	*Cr.* £ s. d.
1892. Jan. 1..	My books to be opened with the following items obtained from Balance taken December 31, 1891. (See p. 295 ledger.)				
	Money in Bank £26 16 0	Dr.—Cash	....	26 16 0	
		Cr.	....	......	
	Valuations—Stock £87 0 0	Dr.—Stock	....	87 0 0	
		Cr.	....	......	
	Crop £70 0 0	Dr.—Crop	....	70 0 0	
		Cr.	....	......	
	Plant £30 0 0	Dr.—Plant	....	30 0 0	
		Cr.	....	......	
	Improvements .. £21 0 0	Dr.—Improvements	....	21 0 0	
		Cr.	....	......	
	Total amount of capital in the business, represented by cash in Bank, value of Stock, Crop, Plant, and Improvements, together with all debts due to me, less all debts due by me, £278 10s. 6d.	Cr.—Capital ..	....	......	278 10 6
	I owe Broadbent £3 18s. 6d.	Cr.—Broadbent ..	....	......	3 18 6
	Davidson owes me £47 13s.	Dr.—Davidson ..	....	47 13 0	......
				282 9 0	282 9 0

When the opening entries for the year 1892 have been duly posted, as directed (*see* journalised items), the transactions for 1892 can be proceeded with, to be first entered in day-book, then journalised, and finally posted into the ledger, according to the rules observed in double entry.

These particulars conclude the explanation as to how to keep farm-books in a simple way, yet with strict accuracy. It is thought advisable, however, to give additional information with regard to some of the subsidiary books, such as are of importance to farmers.

Valuation-book.

In valuing his own property (live stock, plant, improvements, &c.), great care should be taken to set it down at its true market value, as near as can possibly be ascertained.

A valuation by some independent qualified person would be advisable, should any occasion arise warranting such a course. A man may be given to partiality, from a naturally sanguine idea as to the state of his affairs, condition of his stock, &c., possibly over-estimating values in consequence, a position of affairs to be carefully guarded against. Speaking generally, at the end of each year (or at such time as it is desired to close the books and ascertain the exact state of affairs), the owner should take his valuations carefully, and enter full particulars in a valuation-book, kept for the purpose. Such entries should give a correct statement of everything in the way of property, being required for the purpose of drawing up the balance-sheet.

In the valuation of implements full allowance should be made for wear and tear, the amount representing their depreciation in value being proportionate to the length of time during which they may remain in use. For instance, a plough may cost, in the first instance, £4 10s., and each year for three years it may cost £1 in extra attachments and repairs. At the end of (we will say for the sake of illustration) three years it is worn out. It should be valued at the end of the first year at two-thirds of its total cost up to that time—(£4 10s. + £1 = £5 10s., less one-third = value at end of twelve months, £3 13s. 4d.; at end of second year, at one-half its value end of previous year, with the year's expenses (£1) added, namely £3 13s. 4d. + £1 = £4 13s. 4d. ÷ 2 = £2 6s. 8d., value; at the end of the third year it is to be considered of no value at all. Thus we divide the total cost equitably over the three years during which the implement is in use, making it, as we say, "pay for itself," an expression used to indicate that the cost of it has been properly set down to expenses spread over a series of years. This principle should be adopted in case of all valuations when making out the balance-sheet (except, of course, in the case of live stock), crediting the estimated value to the property account interested, and debiting the balance remaining (depreciation) to Profit and Loss account. (*See* ledger, Plant account.)

Of course, something may be obtained for old implements, if only the price of old iron; in such case the amount received should go to the credit of its property account.

Such a method of calculating values is very necessary, especially so when there is a desire to sell out from a leased farm. If tenant right is recognised, that is, the ownership by the lessee of all improvements made by him, it is absolutely essential.

In the valuation of improvements the basis of calculation lies in the fact that such improvements must be unexhausted. They represent capital invested for reproductive purposes, but existing only for a time, which may be short or long, according to circumstances. The amount expended on such

improvements represents their value at the time carried out, but this value will diminish with lapse of time, as the period approaches when it is assumed that their usefulness will altogether expire. In the books, this wearing out of the invested capital should be regulated as here explained. Suppose Williams expends £70 on drainage during 1892, he having seven years of his lease to run. He calculates that this £70 thus laid out has improved his land to the extent of £10 per annum for the seven years he is to retain it. He reckons on obtaining from the land an increase in his crops sufficient to cover the total outlay and interest on the same, thus recouping himself for the outlay by increased returns, due to his expenditure in improvements. On 1st January, 1893, he values the unexhausted portion of his drainage improvements at £60, whilst each succeeding year the value is reduced by £10. Each year, when making up his books, he credits his improvement account with £10, being the calculated amount of depreciation, in value per annum, and he debits this £10 to the expenses of the current year. Capital is therefore represented by so much, invested in improvements, the amount of capital invested in this way being reduced each year as the improvements wear out. At the end of 1898 his ledger would show in this account entries as follows :—

UNEXHAUSTED IMPROVEMENT ACCOUNT.

Cr. | *Dr.*

		£	s.	d.			£	s.	d.
1892	To Cash expended in draining..	70	0	0	1892 Dec. 31	By Depreciation	10	0	0
						„ Valuation	60	0	0
1893	To Valuation	60	0	0	1893 Dec. 31	By Depreciation	10	0	0
						„ Valuation	50	0	0
1894	To Valuation	50	0	0	1894 Dec. 31	By Depreciation	10	0	0
						„ Valuation	40	0	0
1895	To Valuation	40	0	0	1885 Dec. 31	By Depreciation	10	0	0
						„ Valuation	30	0	0
1896	To Valuation	30	0	0	1896 Dec. 31	By Depreciation	10	0	0
						„ Valuation	20	0	0
1897	To Valuation	20	0	0	1897 Dec. 31	By Depreciation	10	0	0
						„ Valuation	10	0	0
		10	0	0	1898 Dec. 31	By Depreciation	10	0	0

The expense, instead of being charged to one year, is thus spread over seven years, and in 1899 there will be no further need to charge any expense for drainage (unless further work has been carried out) against his profits, even if he retain the farm for a further term of years; whilst the effect of the improvements carried out may still exist; the land may benefit for a considerable time after 1898, owing to work carried out in 1892.

This method of dividing large items of expenditure over a term of years may be advantageously carried out in the case of fencing, building, or any payments made under the head of unexhausted improvements; and if the lessee is selling out he has a right to demand fair market value for his improvements, supposing the same to be unexhausted, basing his calculations upon the ledger entries, made according to the plan here set forth.

Below is a page from valuation-book, giving in outline, particulars as to the way in which such records should be kept, more particularly, however, relating to such forms of property as Stock, Crop, and Plant.

VALUATION-BOOK.

Valuations taken, 31st December, 1891.

			£ s. d.	£ s. d.	
Live stock—					
1 horse	VHV near shoulder.	....	14 0 0		
10 milking-cows	....	£5 each ..	50 0 0		
4 calves	....	10s. each ..	2 0 0		
1 bull	....	....	10 0 0		
6 pigs	Half Berkshire ..	£1 each ..	6 0 0		
14 sucking-pigs	....	3s. each ..	2 2 0		
Fowls	....	....	2 18 0		
				87 0 0	Page 4—Day-book.
Crop—					
Maize	300 bushels in barn	2s. per bushel	30 0 0		
Hay	14 tons in stack ..	£2 per ton ..	28 0 0		
Various	In ground and on trees.	....	12 0 0		
				70 0 0	"
Plant—					
1 spring-cart	....	£12	12 0 0		
2 ploughs	....	£3 each ..	6 0 0		
2 harrows	....	£2 each ..	4 0 0		
1 corn-sheller	....	£5	5 0 0		
Other tools	....	....	3 0 0		
				30 0 0	"
Improvements—					
Drainage	Work done this year—value, £24; depreciation, at rate of £3 per annum, from 1st January, 1891. Present value		......	21 0 0	"
	Total valuations ..		£	208 0 0	(See Balance account.)

Labour-book.

Payments for labour may be a large item in the expenditure on a farm, varying in amount from time to time, and in the object for which incurred. A well-arranged book, in which all such amounts as are paid for labour can be entered, offers expedition in classifying the payments, and facilitates transference to the day-book journal, in addition to furnishing an accurate record of work done by the men employed. A man may during the course of a week be employed at very different kinds of work. Each department on the farm should have the amount expended in labour for its benefit, duly charged to its expenses (the amount being debited to the property account and credited to the money account). Under systematic arrangement it is easy to show the extent to which each account should be debited for the period under review. We must, of course, consider that in debiting any items representing expenditure for labour, to Crop, Stock, or other property account, that such property has really benefited by the amount expended on it.

Daily records should be kept as to the time devoted to each branch of work, the necessary entries being made in the labour-book; before paying any wages the book should be made up for the week or fortnight, as the case might be. The necessary condensed particulars should then be entered in the day-book, journalised, and finally posted in the ledger.

Below is a specimen page from a labour-book showing a total of £7 5s. expended on labour (as entered in Williams's books; see his journal under date 30th August). It will be seen that records can be kept down to a single hour; and every shilling of expenditure should be correctly registered, in order that it may be debited to its proper account.

LABOUR-BOOK.

Week Ending.	Name of Labourer.	How Engaged.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Overtime.	Total Time Worked.	Rate of Wages.	Total Wages Earned.	Debit in Ledger as under. Stock.	Crop.	Plant.	Remarks.
1891. Aug. 30	A. Brown..	Reaping ..	1	..	1	1	1	1	..	6	20/- & food.	20/-	3/4	16/8	..	Food debited to Crop account. Aug. 30. Page 3, in day-book.
		Attending Cows.	..	1	..	..	..	..	..							
	J. Allsop ..	Reaping ..	1	1	1	1	1	1	..	6	6/- a day.	36/-	..	36/-	..	
	P. Maher..	Reaping ..	1	1	1	1	1	1	..	6	6/- a day.	41/	..	36/-	5/-	Five hours mending ploughs.
		Plant ..	..	..	..	..	..	..	5/6	5/6	1/- an hour.					
	S. James ..	Reaping ..	1	1	1	1	..	..	..	4	7/- a day.	28/	..	28/-	..	
	H. Watson.	Reaping ..	..	1	..	..	..	..	..	6	20/- & food.	20/-	16/8	3/4	..	Food debited as above. See day-book, page 3.
		Attending Cows.	1	..	1	1	1	1								
												145/-				Total amount paid for wages. See day-book, page 3.
													20/-	120/-	5/-	Debited to Stock. ,, to Crop. ,, to Plant. See day-book, page 3.

In conclusion, I may say that the principle of double entry herein explained is the basis of all good book-keeping. The number of different books to be used, with other details, must be, to some extent, left to the good sense and discretion of the owner. It should always be borne in mind that well-kept books are a distinct stepping-stone to success, not because the books are in themselves neat and precise, but because the man who takes care that his books are thoroughly up to the mark must of necessity be a careful man, and, as already stated, he must, necessarily, be fully acquainted with all the details of his business. One more word: the plan here set forth only represents a small portion of what could be said on the subject—giving *one* example, and fully explaining all details connected with it—as specially applicable to the needs of farmers and orchardists, who cannot give the time necessary for keeping an elaborate set of books; enough has, it is believed, been given to fully elucidate the matter so far as it has been taken. The typical set of accounts made use of as an example forms the text around which the whole scheme is gathered; whilst detail has been entered in the day-book journal example, that, as a matter of fact, after a short practical experience might be considerably curtailed.

I sincerely trust that this small effort in the direction of throwing light on what is looked upon as a most difficult and intricate matter may be found of use by those for whom it is intended. Correct book-keeping, like many another branch of knowledge, is not easily understood when viewed from afar. Once, however, the initial difficulties are overcome, and the underlying principle mastered, book-keeping becomes not only easy to carry out, but a positive liking for it sets in, and what was before called work soon becomes a pleasure.

Determining Butter-fat in Milk.

Pursuant to an announcement in the September issue of the *Agricultural Gazette*, the Department of Agriculture obtained a Babcock milk-tester, which has been submitted to a series of severe tests as to accuracy by the Analytical Chemist, Mr. F. B. Guthrie, and Mr. McCaffrey, Dairy Expert to the Department. The first test was with two samples of milk, eight tubes, being filled with each of the two samples. The results of this test never varied beyond $\frac{1}{5}$ per cent. The second test was to chemically extract the butter-fat by means of ether, and when compared with the results from Babcock's machine, all the tubes, with the exception of one, gave results within $\frac{1}{5}$ per cent. The third test was a comparison of milk in a Babcock machine diluted with an equal bulk of water, as against the theoretical yield calculated from the previous experiment; and here, again, the differences did not exceed $\frac{1}{5}$ per cent. Another test was made with a view to ascertain whether prolonged contact of the milk with the acid before whirling had any appreciable effect on the yield of butter-fat. For this purpose one set of tubes was filled with milk which had been in contact with acid for forty-five minutes, the other set being filled with milk and newly-added acid; and, while the results were not greatly divergent, there was some difficulty in reading the samples which had remained long in contact with the acid, due either to the action of the acid, or to the fact that the temperature during the whirling had been insufficient. Three samples of milk were therefore charged with acid, and allowed to stand for one and a half hours before whirling. The tank was filled with hot water (167 degrees F.), and then whirled and checked with milk containing acid newly added. Both these tests came out satisfactorily as regards the percentage of fat; and, moreover, the experiment proved that, provided hot water is added to the tank, the acid has no appreciable effect upon the milk as regards its capacity for being accurately tested. The conclusions arrived at as a result of these tests are,—that the Babcock machine may be relied on to give results which do not differ more than $\frac{1}{5}$ per cent. from those obtained by the exact chemical process of extraction with ether; that its results are uniform within the same limits; and that the prolonged action of strong acid upon the fat of milk is *nil* within the limit of time occupied by the test; that the reading of the column of fat is unaffected thereby, provided the proper temperature is maintained during whirling; and that, while scrupulous attention to the detailed instructions is absolutely necessary, the machine is sound in principle, and easy to understand and to work. It will be found especially valuable to butter manufacturers, enabling them to purchase milk according to its content of fat, and keeping a ready and effective check upon the quality of the milk supplied. The Babcock machine is to be strongly recommended to all to whom it is of importance to have an expeditious and accurate method of ascertaining the quantities of fat in a number of samples of milk. It has the great advantages over gravimetric methods, that it takes less time (about forty-eight samples may be tested in two hours), and does not require special skill in manipulation. Accuracy and cleanliness are the chief essentials. It should be added, for the benefit of factories and others intending to purchase, that the Department will undertake to test the accuracy of the pipettes and flasks supplied with the plant.

Full details and figures of these experiments will appear in the April issue.—Ed.

Smut in Oats and Wheat.

JENSEN OR HOT-WATER TREATMENT.

THE following is a summary of some investigations conducted at the Michigan Agricultural Experiment Station into this disease, and the value of the hot-water treatment as a preventive for it:—

1. The loss to Michigan this year (1892) in the oat crop alone caused by smut will exceed 1,000,000 dollars, and this is a low estimate.
2. The smut of oats and stinking smut of wheat are parasitic plants.
3. The spores of these smuts attach themselves to the kernels of oats or wheat, and are sown with them.
4. The spores germinate at about the same time the seed germinates, and in some way enter the young plant, and live upon it, until finally the head of smut appears.
5. Both of these smuts can be entirely prevented at a slight expense by the Jensen or hot-water treatment.
6. For wheat, the temperature of the water in kettle No. 2 (*see* "Method of Treatment") should be 134 or 135 degrees when the seed is put in. The seed should be taken out in ten minutes if the temperature does not fall below 133 degrees F.; if below 133 degrees, it should be left in fifteen minutes, or even a little longer if the temperature should fall below 130 degrees.
7. For oats the temperature of the water should be 139 or 140 degrees when the oats are put in, and they should be taken out in ten minutes if the temperature is not below 135 degrees F. If below 135 degrees F. at the end of ten minutes they should be left in fifteen minutes, unless the temperature falls below 130 degrees F., when they should be left in a little longer. During treatment see that the water in kettle No. 2 does not rise above 135 degrees for wheat and 140 degrees for oats.
8. Professors Jensen, Swingle, Kellerman, Arthur, and others have found that this treatment not only removes the smut from the crop, but improves the growth and increases the yield.
9. The increased yield is sufficient to pay for the labour and trouble of treatment several times over.
10. Do not conclude that you have no smut because you do not see it. In the case of oats, the smut is mostly blown off before harvest, and the smutted stalks being shorter than the healthy ones, are not observed.
11. What the farmers of Michigan term "low smut" of wheat is a different species from the "high smut," but both are subject to the same treatment.

A full report on smuts by Dr. Cobb, Pathologist of the Department, has already been published in the *Agricultural Gazette*, Vol. II, Pt. 11, in which the remedies suggested are adapted for the conditions of New South Wales.

Method of Treatment for Wheat.

This method of treating wheat and oats as a preventive for smut was discovered by J. L. Jensen, of Denmark, in 1887, and it has since been proved that the adhering spores of smut are killed by dipping the seed in hot water without impairing the vitality of the seed. The mode of procedure is as follows:—Have two kettles of water—one heated to a temperature of from 110 to 130 degrees F., the other to 135 degrees F. The first is for the purpose of warming the seed preparatory to its being placed in the warmer water. Unless this precaution is taken it will be difficult to keep the water in the second vessel at the proper temperature. The seed to be treated should be placed in a sack that will allow the water to pass through readily (a coarse gunny sack is good). According to the size of the kettles, the sack may contain from one-half to 1 bushel. Dip the wheat into kettle No. 1 (110 to 130 degrees), lifting it out and plunging it in two or three times. This process will take but a minute or so. Then dip it into the warmer water, keeping the wheat in the bag well stirred. The best plan is to lift it out and plunge it in several times. This should be continued ten to fifteen minutes, according to the temperature of the water, and the grain then spread out to dry. A second person should regulate the temperature of the water, and do nothing else. Probably it will be found best to have a fire under kettle No. 2 sufficient to raise the water to 145 or 150 degrees F., and then add cold water to reduce it to 134 or 135 degrees F. when the seed is put in. *If, at the end of ten minutes, the temperature of the water has not been reduced below* 133 *degrees*, the seed should be removed and dipped into cold water. If below 133 degrees F., it should be left in fifteen minutes, or even longer if the temperature should fall below 130 degrees F.

Oats.

The treatment is essentially the same for oats, except that the temperature of the water in kettle No. 2 should be 130 or 140 degrees F. when the oats are put in. If, at the end of ten minutes, the temperature is not below 135 degrees, they should be left in fifteen minutes, or even longer if the temperature falls below 130 degrees. When taken out, the grain should be dipped in cold water.

It may be stated that hundreds of experiments, conducted at different agricultural-experiment stations in the United States, have proved the success of this method, and it is claimed that as a result of the dipping in hot water the yield is increased by more than 5 per cent.

Experiments with a Gummy Substance obtained from Sugar-cane Juice at the Louisiana State Sugar-station.

F. B. GUTHRIE.

In view of the importance attaching to any work bearing on diseases peculiar to sugar-cane, it may be of interest to refer to some work done by Messrs. Horton and Taylor, of the Louisiana State Sugar-experiment Station. They describe a gumlike substance which is found adhering to the under surface of the sieves used to separate the bagasse from the juice coming from the mill, also to the sides and bottoms of the juice-tanks, and elsewhere in the sugar-house. (This substance they have identified with "dextran," a gummy substance occurring in unripe beet-roots, and also in the lactic fermentation of sugar.)

This gummy substance is produced, according to Messrs. Horton and Taylor, by a micro-organism, which they call *Bacterium sacchari*, and which they have successfully reproduced in pure culture solutions.

They calculated that from 10 per cent. to 40 per cent. of the "Wagon" sugar of the State is destroyed from this cause.

The bacterium resists a temperature of 300 degrees F. and boiling with 90 per cent. of alcohol. It is therefore very difficult to kill, and propagates itself at an enormous rate in sugar solutions, which it converts into this gumlike substance.

It is not impossible that the above-described gum may be identical with, or similar to, the yellow gummy moss which is described as exuding from the stalks of Queensland canes affected by the disease known as "checked, arrow," and the formation of this gum may be due to the same cause.

It might also be mentioned that at the conference of sugar-cane-growers which was held at Chatsworth in November last, for the purpose of discussing the disorder which had appeared in the cane crops on our northern rivers, great importance was attached by all the speakers to the presence of a yellow gum, many growers maintaining that it was only by the presence of this matter that they are able to judge whether a cane was diseased or not.

A similar micro-organism to the *Bacterium sacchari* occurring in the beet-root has been the cause of much trouble to the manufacturers of beet sugar; but Messrs. Horton and Taylor have not been able to suggest any remedy for this evil.

New Varieties of Sugar-cane from Louisiana Sugar-experiment Station.

As notified in the December number of the *Gazette*, the Department has taken steps to procure from the leading sugar-cane-growing countries new varieties of cane, which, it is believed, will prove suitable for cultivation on our northern rivers. The first consignment of these canes is now to hand from the State sugar-experiment station, New Orleans, Louisiana, and consists of ten varieties, as described in the following list:—

1st. Panaché (sometimes called Beltran). Stalk long and medium size; colour, green, yellow, or white, with black bloom adhering just above nodes; eyes flat and not prominent; stubbles well. A very fine cane.

2nd. Hope. Received from botanical gardens, Jamaica. Stalks medium, of light purple, and resembles Light Java, except the joints are longer.

3rd. Kokea. Stalks medium and tall; green, with red stripes scarcely perceptible; a very promising cane.

4th. Cavengerie. Originally from Queensland. Stalks large and tall; dark red, with faintly black stripes; closely adherent top leaves more or less variegated with white stripes; very productive suckers, and stubbles well; tonnage very large. Its only defect is its low sugar content, which improves with acclimation.

5th. Grande Savanne. From botanical gardens, Jamaica. Stalks small; very numerous; erect; light purple; leaves dark green and broad; suckers enormously.

6th. Light Java. From botanical gardens, Jamaica. Stalks small; colour light purple; leaves heavy; not a promising cane.

7th. Papuha. Native of Hawaiian Islands. Stalks large and tall; greenish yellow, with faintly-red narrow stripes; suckers well, and so far stubbles well.

8th. Norman. From botanical gardens, Jamaica. Stalks small, numerous, and erect; of light purple colour; leaves pale green, with light-purplish vein down the centre of each; suckers well.

9th. Naga. From botanical gardens, Jamaica. Stalks small, but numerous; colour, deep purple, nearly black; leaves moderately heavy, but narrow. Is highly recommended as a forage-plant. This cane, and Grand Savanne, and Norman, belong to a peculiar type of canes, of which the Japanese is a familiar example. They are not promising as sugar-plants, save, possibly, in higher latitudes, where their resistance to cold may outweigh their sugar defects.

10th. Japanese. This variety is not described, but it is evidently somewhat similar to the cane last described—Naga.

The following description is also given of Louzier, one of the canes received from Mauritius in 1890, and recently distributed on the Clarence and Richmond Rivers:—

Louzier. Originally from Mauritius. A vigorous grower; suckers very well; stalks greenish-yellow, with rose tints; large; leaves abundant; very green and sheaths full of bristles; eyes, full, medium size, and pointed.

As the cuttings arrived in a somewhat dry condition, they were immersed for twenty-four hours in a solution of 1 oz. carbolic acid to 3 gallons water, in order to destroy any insect germs, and at once despatched to the Clarence, where they have been entrusted to the care of Mr. A. Garvan and Mr. David Miller, of Palmer's Island, who have nurseries specially adapted for the propagation of new canes. Our inspector at Grafton will furnish reports from time to time for publication in the *Gazette* as to the progress made by the cuttings, and no efforts will be spared to successfully propagate the canes, so as to secure a supply for distribution to sugar-planters who are anxious to test the suitability of these varieties for our conditions.

Analyses of Commercial Fertilisers, &c.

By F. B. GUTHRIE,
Departmental Analyst.

With Notes by the Director of Agriculture.

Sulphate of Potash.

A sample of sulphate of potash from A. Blumenthal, Hamburg, Germany (Sydney agents, Messrs. Jules Renard & Co.), has been submitted to analysis by the Departmental Analyst, with the following very satisfactory results:—

Potash	52·376 per cent.
Equal to sulphate of potash	96·602 „

In commenting upon this sample the Director states:—

"With kainit at 70s. per ton, this concentrated salt is worth over £15 per ton. So long as this can be imported of the above quality, and at a fair price—say, £13 a ton, without the 10 per cent. duty—it can be strongly recommended to fruit-growers and others in preference to any less concentrated form of potash, though apparently lower in price.

"Two cwt. of this manure, mixed with 1 ton of good bone-dust and dried blood, will make a most valuable complete manure, containing over 4½ per cent. of potash, which should suit nearly all vegetables, green crops, citrus and summer fruits.

"Four cwt. of this salt, added to a ton of blood and bones, would make a manure containing over 8½ per cent. of potash—invaluable for all stone fruits, vines, potatoes, and artichokes."

Kainit.

A sample of kainit from A. Blumenthal, Hamburg, Germany, obtained from the local agents, Messrs. Jules Renard & Co., Sydney, has been submitted to analysis by the Departmental Analyst, with the following results:—

Pure potash	12·956 per cent.	
equal to	23·963 „	of sulphate of potash.

This manure is sold with a guaranteed analysis of 12·4 per cent. potash, and our readers will notice that the sample examined fully bears out this guarantee.

If sulphate of potash giving over 48 per cent. of potash can be sold at £13 a ton, this manure should be worth about 70s. a ton. If it cannot be sold at that price the concentrated sulphate of potash will be more economical for most purposes. Kainit contains, besides the sulphate of potash, about 33 per cent. of common salt, and varying per centages of salts of magnesia (sulphate and chloride), which seem to supplement the value of the potash, especially for potatoes, Swede turnips, and mangolds.

Bone-dust from Bulli.

A sample of bone-dust, manufactured by Mr. D. Davis, of Bulli, has been received by the Department, and an analysis of it by the Departmental Analyst gives the following results:—

Water	5·830	per cent.	
Organic matter	30·219	,,	(containing nitrogen, 3·556 per cent.)
Mineral matter	63·951	,,	
Phosphate of lime	50·494	,,	(containing phosphoric acid, 23·129 per cent.)
Sand, &c.	2·851	,,	

The Director regards this as a very good bone-dust, made from genuine bones, with nothing of manurial value removed. If the bones were ground as fine as flour they would have a much higher manurial value. In their present coarse state they are worth £5 5s. a ton. We are now informed that Mr. Davis has obtained the necessary appliances to grind his bone-dust much finer, which will render it still more valuable to farmers and orchardists.

Boiling-down Refuse from Wagga Wagga.

A sample of soft bones, offal, dried blood, and meat from the boiling-down works of Mr. T. Halloran, at Lake Albert, Wagga Wagga, has been submitted to analysis by the Departmental Analyst, and has given the following results:—

Water	6·590 per cent.
Organic matter	36·607 ,,
(Containing nitrogen = 2·820 per cent.; ammonia = 3·424 per cent.)	
Mineral matter	56·803 per cent.
Containing—	
Insoluble matter ...	6·757 ,,
Phosphate of lime ...	40·473 ,,
(Containing 18·538 phosphoric acid.)	
Carbonate of lime	8·478 per cent.
Mechanically it is composed of—	
Fine particles	20 per cent.
Medium	24 ,,
Coarse	56 ,,

In forwarding this analysis the Director states:—As this is a waste product, and can, therefore, be sold very cheap on the spot, it is worthy the attention of all farmers, orchardists, and gardeners needing manure. It would be very valuable for most of the Wagga Wagga soils, and would replace the very constituents removed by the wheat crops to the greatest extent. The extraneous lime shown by analysis has been added to dry the refuse, and keep down the offensive smell given off by the heap when exposed to the air. Mr. Halloran offers the manure at 30s. per ton.

In order to make it a perfect manure, 1 cwt. of sulphate of potash should be added to each ton of this mixture. It should be composted now, and covered with 4 to 6 inches of loam, properly pitched and well beaten, to throw off rain. When cut down and mixed, in a few months it would make a cheap and valuable plant-food for wheat, fruit, vines, or roots. The proper quantity of this manure to apply to wheat would be 4 cwt. per acre; and for fruit, up to 10 cwt. per acre might be used.

The manurial value in its present coarse state is 85s. per ton. If ground up fine, as could easily be done by a small mill, for the bones are exceedingly soft, the value might be estimated at 98s.

BOILING-DOWN REFUSE FROM ARNCLIFFE.

A SAMPLE from the boiling-down works of Mr. H. McNamara at Arncliffe, has been received, which is exactly similar in every way to the above. It is offered at 30s. a ton (bags 5s. extra) on board the trucks at Arncliffe. It is a very cheap manure for grass, hay and fruit. It ought to be composted with one-tenth its own weight of sulphate of potash, or one-fourth of kainit, and applied at the end of winter.

SHELL DEPOSIT FROM A CAVE ON THE HAWKESBURY RIVER.

A SAMPLE of shell deposit obtained in a cave on the Hawkesbury was submitted for examination by the Departmental Analyst, who found the sample to contain a little nitrogenous matter and potash, magnesia and phosphoric acid, besides the carbonate of lime of the shells, and sand accidentally present.

The Director values the deposit at £1 per ton for orchard use, and recommends it to be composted with tan-yard refuse, boiling-down refuse, or any natural manure, and applied at the rate of 1 ton per acre, or else put on the land broadcast and scarified in. Low standard material of this sort is of course not worth much for freight and cartage, the utmost value—landed on the orchard—being the price mentioned.

FLUE DEPOSITS.

A SAMPLE of flue deposit, from Maitland, has been submitted for analysis by the Departmental Analyst, and the following results obtained:—

Water	1·837 per cent.	
Organic matter	4·624 ,,	(containing nitrogen = 0·064)
Insoluble matter and sand ...	83·751 ,,	
Lime	2·564 ,,	
Phosphoric acid	0·321 ,,	
Potash	0·309 ,,	

A fair quantity of sulphates were present, probably combined with lime, and traces of chlorides.

The analysis shows the fertilising substances to be present in extremely small quantities, and the manurial value is about 5s. per ton.

The deposit might be of value for mixing with clayey soils to open them up, if available close at hand, without much expense for cartage.

Another sample of flue deposit, from Liverpool, was of the following composition:—

Water	·672 per cent.
Organic matter	1·212 ,,
Sand and insoluble matter	91·173 ,,
Soluble silica and alumina	4·161 ,,
Peroxide of iron	·228 ,,
Lime	·426 ,,
Magnesia	·235 ,,
Potash	·172 ,,
Phosphoric acid	1·296 ,,
Sulphates	·288 ,,

The fertilising value of this deposit is very small—5s. 8d. per ton; but the large quantity of sandy matter would probably prove beneficial as an admixture to clayey soils, to render them more easy to cultivate, and less liable to bake in dry weather; worth carting a mile if obtainable for nothing.

Analyses of Soils.

By F. B. GUTHRIE,
Departmental Analyst.

WITH NOTES BY THE DIRECTOR OF AGRICULTURE.

GOSFORD.

A SAMPLE of soil from Gosford has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The geological formation of the surrounding country is Hawkesbury sandstone; the nature of the soil is sandy loam; the reaction of the soil is neutral; and its capacity for water, 35·66 per cent.; absolute weight per acre, 6 inches deep, 3,112,148 lb.

A mechanical analysis of this soil shows that it contains of root-fibres, 0·4 per cent.; stones over ¼ inch in diameter, ·89 per cent.; coarse gravel, more than $\frac{1}{10}$ inch diameter, 1·00 per cent.; fine gravel, more than $\frac{1}{20}$ inch diameter, 2·70 per cent.; fine soil, 95·37 per cent., comprising sand, 65·56 per cent., and impalpable matter, chiefly clay, 29·81 per cent.

An analysis of the fine soil discloses moisture, 2·045 per cent., and volatile and combustible matter, principally organic, 5·893 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of:—Lime (CaO), ·136 per cent., the general value of which is satisfactory, being equivalent to 4,216 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·085 per cent., the general value of which is satisfactory, being equivalent to 2,635 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·055 per cent., the general value of which is fair, being equivalent to 1,705 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·128 per cent. (equal to ·156 per cent. of ammonia), the general value of which is satisfactory, being equivalent to 3,968 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·110 per cent., the general value of which is satisfactory; ferric oxide (Fe_2O_3), ·857 per cent.; general value deficient; and sulphuric acid (SO_3), ·039 per cent.; general value satisfactory; ferrous oxide, ·396 per cent.

In connection with the foregoing particulars, there are no special points of value, and its special defect is phosphoric acid. Its general character mechanically is very good, and chemically moderately good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are fruit and vegetables, with

NOTE.—(*a*) This amount of lime would be supplied in 4,684 lb. of quicklime, or 6,324 lb. of slaked lime, or 8,432 lb. of chalk. (*b*) This amount of potash would be supplied in 5,270 lb. of commercial sulphate of potash, or 21,949 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 6,820 lb. of commercial bone-dust, or 10,230 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 19,840 lb. of sulphate of ammonia, or 23,808 lb. of nitrate of soda.

manure, while it is unsuitable, without special manure or special treatment, for grain or heavy crops of hay. The manures and treatment recommended for trial are draining to deepen the soil and allow trees more room for roots, manuring with Sugar Company's No. 3 manure, or Gee's P.B.B. manure, 4 cwt. per acre; all available manures should be utilised—leaves, dung, bush-scrapings, bones, ashes, and night-soil. Speaking generally, if plenty of natural manure can be got it should be enriched with bone-dust, 2 cwt. to each ton of the compost, to supply the phosphoric acid deficient in the soil and so much needed for citrus fruit, apples, and vegetables.

Cobar.

A sample of soil from Cobar has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is sandy loam; the reaction of the soil is neutral; and its capacity for water, 28·33 per cent; absolute weight per acre, 6 inches deep, 3,367,286 lb.

A mechanical analysis of this soil shows that it contains of root-fibres, none; stones over ¼ inch in diameter, 1·52 per cent.; coarse gravel, more than $\frac{1}{10}$-inch diameter, 6·70 per cent.; fine gravel, more than $\frac{1}{50}$-inch diameter, 6·47 per cent.; fine soil, 85·31 per cent., comprising sand, 49·43 per cent., and impalpable matter, chiefly clay, 35·88 per cent.

An analysis of the fine soil discloses moisture, 2·592 per cent., and volatile and combustible matter, principally organic, 4·413 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of:—Lime (CaO), ·187 per cent., the general value of which is satisfactory, being equivalent to 6,171 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·379 per cent., the general value of which is good, being equivalent to 12,507 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·054 per cent., the general value of which is fair, being equivalent to 1,782 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·112 per cent. (equal to ·136 per cent. of ammonia), the general value of which is satisfactory, being equivalent to 3,692 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·245, general value of which is good; ferric oxide (Fe_2O_3), 2·514 per cent.; general value, deficient; and sulphuric acid (SO_3), ·011 per cent.; general value bad; ferrous oxide, ·144 per cent.

In connection with the foregoing particulars, the special point of value in the soil is potash, and its special defects, phosphoric acid, organic matter, and sulphates; also its low capacity for water. Its general character mechanically is very fair, and chemically fair. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are grapes, olives, beans, wheat (*fair* crops); while it is unsuitable, without special manure or special treatment, for heavy crops of cereals, hay, and roots.

The manures and treatment recommended for trial are Sugar Company's No. 2 manure, or good bone-dust and dried blood (Gee's fertiliser), 4 cwt. per acre. All animal manures that are obtainable should be used, and gypsum, if available at a cheap rate, would be very useful with dung.

Note.—(*a*) This amount of lime would be supplied in 6,856 lb. of quicklime, or 9,256 lb. of slaked lime, or 7,420 lb. of chalk. (*b*) This amount of potash would be supplied in 25,014 lb. of commercial sulphate of potash, or 104,183 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 7,128 lb. of commercial bone-dust, or 10,692 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 18,480 lb. of sulphate of ammonia, or 22,176 lb. of nitrate of soda.

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Sugar Company's No. 2 contains about 80 per cent. of gypsum. Speaking generally, green manuring with peas or vetches would improve this soil very much, and make it more retentive of moisture. It should bear fair crops of wheat for a few years with a fair rainfall, but the phosphates and nitrogenous matter would be exhausted first; hence the advice to use the manures indicated, if only 2 cwt. per acre, to keep the ground in good heart.

West Bargo.

A SAMPLE of soil from West Bargo has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is clay loam; the reaction of the soil is neutral; and its capacity for water, 58·33 per cent.; absolute weight per acre, 6 inches deep, 2,058,030 lb.

A mechanical analysis of this soil shows that it contains of root-fibres, ·37 per cent.; stones over ¼ inch in diameter, 1·10 per cent.; coarse gravel, more than $\frac{1}{10}$-inch diameter, 3·20 per cent.; fine gravel, more than $\frac{1}{50}$-inch diameter, 2·56 per cent.; fine soil, 92·77 per cent., comprising sand, 21·31 per cent., and impalpable matter, chiefly clay, 71·46 per cent.

An analysis of the fine soil discloses moisture, 4·687 per cent., and volatile and combustible matter, principally organic, 12·348 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consists of:—Lime (CaO), ·084 per cent., the general value of which is fair, being equivalent to 1,680 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·140 per cent., the general value of which is satisfactory, being equivalent to 2,850 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·064 per cent., the general value of which is fair, being equivalent to 1,380 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·285 per cent. (equal to ·346 per cent. of ammonia), the general value of which is good, being equivalent to 5,700 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·128 per cent., general value of which is satisfactory; ferric oxide (Fe_2O_3) ·422 per cent., general value deficient; and sulphuric acid (SO_3), ·025 per cent., general value bad; ferrous oxide, 1·296 per cent.

In connection with the foregoing particulars, the special points of value in the soil are capacity for water and organic matter (containing nitrogen); and its special defects, phosphoric acid and lime. Its general character mechanically is fair, and chemically, fair. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are summer fruit, vegetables, maize, and green feed, while it is unsuitable, without special manure or special treatment, for citrus fruit, roots, and delicate flowers.

The manures and treatment recommended for trial are—lime, 1 ton per acre, to mellow the soil, reduce the clay, and liberate the potash now locked up in it; draining with stones or pipes, to improve the subsoil, 2 feet deep and 20 feet apart; manuring with 5 cwt. per acre of Gee's fertiliser in autumn or winter.

NOTE.—(*a*) This amount of lime would be supplied in 1,866 lb. of quicklime, or 2,520 lb. of slaked lime, or 3,360 lb. of chalk. (*b*) This amount of potash would be supplied in 5,600 lb. of commercial sulphate of potash, or 23,324 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 5,520 lb. of commercial bone-dust, or 8,280 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 28,500 lb. of sulphate of ammonia, or 34,200 lb. of nitrate of soda.

Speaking generally, with Gee's BB manure, this soil ought to grow good crops of maize, sorghum, and hay; with PBB, No. 1 (containing 2½ per cent. potash), and drainage, which is indispensable, it should grow excellent crops of peaches, apricots, nectarines, pears, plums, apples, and vegetables.

INVERELL (BYRON DISTRICT).

A SAMPLE of soil from Byron, Inverell District, has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is stiff loam; the nature of the subsoil, clay and small stones; the reaction of the soil is neutral; and its capacity for water, 62·337 per cent; absolute weight per acre, 6 inches deep, 2,850,983 lb.

A mechanical analysis of this soil shows that it contains no root-fibres; stones over ¼ inch in diameter, none; coarse gravel, more than $\frac{1}{10}$-inch diameter, none; fine gravel, more than $\frac{1}{50}$-inch diameter, 1·31 per cent.; fine soil, 98·69 per cent., comprising sand, 50·31 per cent., and impalpable matter, chiefly clay, 48·38 per cent.

An analysis of the fine soil discloses moisture, 10·248 per cent., and volatile and combustible matter, principally organic, 9·439 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of:—Lime (CaO), ·538 per cent., the general value of which is very good, being equivalent to 15,061 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·380 per cent., the general value of which is good, being equivalent to 10,640 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·161 per cent., the general value of which is good, being equivalent to 4,508 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·190 per cent. (equal to ·231 per cent. of ammonia), the general value of which is good, being equivalent to 5,320 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·726 per cent., general value of which is very good; ferric oxide (Fe_2O_3), 5·854 per cent., general value satisfactory; and sulphuric acid (SO_3), ·024 per cent., general value satisfactory; ferrous oxide, 1·512 per cent.

In connection with the foregoing particulars, the special points of value in the soil are potash and phosphoric acid, and its special defect, its stiff nature. Its general character mechanically is fair, and chemically, very rich. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are lucerne, wheat, hay, maize, sorghum, beans, and peas; while it is unsuitable, without special manure or special treatment, for roots, citrus fruits, and barley. The manures and treatment recommended for trial are opening up to the beneficial action of the air as much as possible; treating with lime (if available in the district), 1 ton per acre, to burst up the clay, and mellow the stiff soil.

Speaking generally, this is one of the most uniformly rich soils yet examined in the Department, and should, with proper cultivation, give good crops of anything suited to the climate, for many years to come. Liming would greatly improve the mechanical texture of the soil, and also liberate the potash from the clay. Drainage would be of great value for citrus fruit.

NOTE.—(*a*) This amount of lime would be supplied in 18,733 lb. of quicklime, or 22,596 lb. of slaked lime, or 30,128 lb. of chalk. (*b*) This amount of potash would be supplied in 21,280 lb. of commercial sulphate of potash, or 88,631 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 18,032 lb. of commercial bone-dust, or 27,048 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 26,600 lb. of sulphate of ammonia, or 31,920 lb. of nitrate of soda.

Inverell.

A sample of red soil from Inverell has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is loam; the reaction of the soil is neutral; and its capacity for water, 44·33 per cent.; absolute weight per acre, 6 inches deep, 2,494,114 lb.

A mechanical analysis of this soil shows that it contains root-fibres; no stones over ¼ inch in diameter; coarse gravel, more than $\frac{1}{10}$-inch diameter, 9·91 per cent.; fine gravel, more than $\frac{1}{50}$-inch diameter, 18·91 per cent.; fine soil, 71·18 per cent., comprising sand, 30·41 per cent., and impalpable matter, chiefly clay, 40·77 per cent.

An analysis of the fine soil discloses moisture, 6·919 per cent., and volatile and combustible matter, principally organic, 8·692 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of:—Lime (CaO), ·430 per cent, the general value of which is good, being equivalent to 10,320 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·461 per cent., the general value of which is very good, being equivalent to 11,064 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·357 per cent., the general value of which is good, being equivalent to 8,568 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·140 per cent. (equal to ·190 per cent. of ammonia), the general value of which is satisfactory, being equivalent to 3,360 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·193 per cent., general value of which is satisfactory; ferric oxide (Fe_2O_3), 12,063 per cent., general value excessive; and sulphuric acid (SO_3), ·032 per cent., general value indifferent.

In connection with the foregoing particulars, the special points of value in the soil are potash and phosphoric acid, and its special defect, excess of oxides of iron. Its general character mechanically is good, and chemically, very rich. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are any crops suited to the climate, with the exception of maize and grasses, which will probably do better after a few years' cultivation. No manures should be needed for some years. Lime, or sulphate of lime (gypsum), would benefit the soil very much; worth a trial if procurable at a moderate price.

Speaking generally, lime (1 ton per acre), or gypsum (10 cwt. per acre), would liberate the large supplies of latent or insoluble potash, and thus be very beneficial to clovers, potatoes, and vines; it would also neutralise the excessive iron oxides. The lower oxide, which is deleterious, will be changed into the higher and better form of iron by means of bare fallowing and opening up to the air.

Narrabri.

A sample of soil from Narrabri has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is clay loam; the reaction of the soil is neutral; and its capacity for water, 42 per cent; absolute weight per acre, 6 inches deep, 2,799,958 lb.

Note.—(*a*) This amount of lime would be supplied in 11,466 lb. of quicklime, or 15,480 lb. of slaked lime, or 20,640 lb. of chalk. (*b*) This amount of potash would be supplied in 22,128 lb. of commercial sulphate of potash, or 92,163 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 34,272 lb. of commercial bone-dust, or 51,408 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 16,800 lb. of sulphate of ammonia, or 20,160 lb. of nitrate of soda.

A mechanical analysis of this soil shows that it contains no root-fibres; no stones over ¼ inch in diameter; coarse gravel, more than $\frac{1}{10}$-inch diameter, ·5 per cent.; fine gravel, more than $\frac{1}{50}$-inch diameter, 1·98 per cent.; fine soil, 97·52 per cent., comprising sand, 23·66 per cent., and impalpable matter, chiefly clay, 73·86 per cent.

An analysis of the fine soil discloses moisture, 3·312 per cent., and volatile and combustible matter, principally organic, 5·143 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of:—Lime (CaO), ·497 per cent., the general value of which is good, being equivalent to 13,419 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·312 per cent., the general value of which is good, being equivalent to 8,424 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·192 per cent., the general value of which is good, being equivalent to 5,184 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·157 per cent. (equal to ·190 per cent. of ammonia), the general value of which is good, being equivalent to 4,239lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·202 per cent., general value of which is good; ferric oxide (Fe_2O_3), 4·057 per cent., general value satisfactory; and sulphuric acid (SO_3), ·070 per cent.; general value fair; ferrous oxide, ·504 per cent.

In connection with the foregoing particulars, the special points of value in the soil are phosphoric acid and potash, and its special defect is its stiff character. Its general character mechanically is tolerable, and chemically, good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are cereals, summer fruits, beans, peas, and hay; while it is unsuitable, without special manure or special treatment, for potatoes, citrus fruit, roots, and any other crops needing frequent and regular rainfall. The manures and treatment recommended for trial are liming (10 to 20 cwt. per acre), fallowing as much as possible to decompose the clay, liberate the potash, and mellow the soil.

Speaking generally, this soil should need no manure for some time; the first to be needed will probably be some nitrogenous manure such as dried blood, 2 cwt. per acre, which would pay well for all green crops. Liming would improve the mechanical condition of the soil, and liberate plant-food now latent. It should then grow any crop suited to the climate and rainfall.

Don Dorrigo.

A sample of soil from Don Dorrigo (headwaters of Nymboyda River, Clarence River District) has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is sandy loam; the reaction of the soil is neutral; and its capacity for water, 61·66 per cent; absolute weight per acre, soil 6 inches deep, 2,130,494 lb.

A mechanical analysis of this soil shows that it contains of root-fibres, 1·50 per cent.; stones over ¼ inch in diameter, 46·3 per cent.; coarse gravel, more than $\frac{1}{10}$-in chdiameter, 3·81 per cent.; fine gravel, more than $\frac{1}{50}$-inch diameter,

Note.—(*a*) This amount of lime would be supplied in 14,910 lb. of quicklime, or 20,128 lb. of slaked lime, or 26,838 lb. of chalk. (*b*) This amount of potash would be supplied in 16,848 lb. of commercial sulphate of potash, or 70,171 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 20,736 lb. of commercial bone-dust, or 31,104 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 21,195 lb. of sulphate of ammonia, or 25,434 lb. of nitrate of soda.

14·75 per cent.; fine soil, 75·81 per cent., comprising sand, 46·33 per cent., and impalpable matter, chiefly clay, 28·48 per cent.

An analysis of the fine soil discloses moisture, 8·894 per cent., and volatile and combustible matter, principally organic, 28·376 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of:—Lime (CaO), 1·155 per cent., the general value of which is very good, being equivalent to 24,255 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·121 per cent., the general value of which is satisfactory, being equivalent to 2,541 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·396 per cent., the general value of which is good, being equivalent to 8,316 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·811 per cent. (equal to ·986 per cent. of ammonia), the general value of which is excellent, being equivalent to 17,031 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·745 per cent., general value of which is very good; ferric oxide (Fe_2O_3), 2·853 per cent., general value satisfactory; and sulphuric acid (SO_3), ·076 per cent., general value fair; ferrous oxide, 7·056 per cent.

In connection with the foregoing particulars, the special points of value in the soil are nitrogenous (organic) matter, phosphoric acid, and capacity for water; and its special defect is an excess of the lower (black) oxide of iron, which is injurious to many forms of vegetation. Its general character mechanically is good, and chemically, very good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are any crops suited to the climate, after proper treatment.

The manures and treatment recommended for trial are opening the ground to the air as much as possible to let the oxygen convert the injurious black oxide of iron into the red oxide (rust). Lime or gypsum (if available at a reasonable cost) would be very effective in aiding this work.

Speaking generally, this is a rich soil, which should give good results with all crops suited to the climate after it has been sweetened by thorough fallowing and deep cultivation.

CHATSWORTH.

A SAMPLE of soil (A) from Chatsworth, Clarence River, has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is clay loam; the reaction of the soil is neutral, and its capacity for water, 50·33 per cent; absolute weight per acre, 6 inches deep, 2,479,554 lb.

A mechanical analysis of this soil shows that it contains of root-fibres, ·06 per cent.; no stones over ½ inch in diameter,; no coarse gravel, more than $\frac{1}{10}$-inch diameter; fine gravel, more than $\frac{1}{20}$-inch diameter, ·5 per cent.; fine soil, 99·44 per cent., comprising sand, 37·00 per cent., and impalpable matter, chiefly clay, 62·44 per cent.

An analysis of the fine soil discloses moisture, 3·009 per cent., and volatile and combustible matter, principally organic, 6·218 per cent.

NOTE.—(*a*) This amount of lime would be supplied in 26,950 lb. of quicklime, or 36,382 lb. of slaked lime, or 48,510 lb. of chalk. (*b*) This amount of potash would be supplied in 5,082 lb. of commercial sulphate of potash, or 21,166 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 33,264 lb. of commercial bone-dust, or 49,896 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 85,155 lb. of sulphate of ammonia, or 102,186 lb. of nitrate of soda.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of:—Lime (CaO), ·436 per cent., the general value of which is good, being equivalent to 10,464 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·558 per cent., the general value of which is very good, being equivalent to 13,392 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·137 per cent., the general value of which is satisfactory, being equivalent to 3,288 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·156 per cent. (equal to ·190 per cent. of ammonia), the general value of which is good, being equivalent to 3,744 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·448 per cent., general value of which is good; ferric oxide (Fe_2O_3), 2·414 per cent., general value satisfactory; and sulphuric acid (SO_3), ·042 per cent., general value indifferent; ferrous oxide, ·936 per cent.

In connection with the foregoing particulars, the special point of value in the soil is potash, and its special defect is its stiff nature, heavy to work. Its general character mechanically is fair, and chemically, good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are beans, maize, oats, and cane; while it is unsuitable, without special manure or special treatment, for roots, vegetables, and citrus fruits. The manures and treatment recommended for trial are lime in autumn, 1 ton per acre, after ploughing and harrowing; 4 cwt. good bone-dust, or bones and blood, per acre at end of winter, or Sugar Company's No. 2 manure, same weight, in early spring; deep ploughing and fallowing will enable the air to liberate a great quantity of valuable plant-food.

Speaking generally, the lime should be scattered broadcast on the surface; it will soon sink. The bone-dust, or Sugar Company's No. 2, should be placed within reach of the roots; the latter being soluble, should only be lightly harrowed in, and should not be applied with lime, or within three months from time of using it.

NOTE.—(*a*) This amount of lime would be supplied in 11,625 lb. of quicklime, or 15,696 lb. of slaked lime, or 20,928 lb. of chalk. (*b*) This amount of potash would be supplied in 26,784 lb. of commercial sulphate of potash, or 111,555 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 3,152 lb. of commercial bone-dust, or 19,728 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 18,720 lb. of sulphate of ammonia, or 22 464 lb. of nitrate of soda.

Poultry.

BY THE SUB-EDITOR.

EGG-PRODUCERS AND EXPERIMENTS IN EGG-PRODUCTION.

IT is not at all uncommon to find advertisements setting forth the virtues of a particular variety of fowl, and giving the results of trials in egg-production against other varieties. The results given may be perfectly correct, and yet the variety mentioned may not be the most prolific layers.

This may, at first glance, appear to be a paradoxical statement; I shall, however, endeavour to show clearly that this is not the case, with a view to helping farmers, who might be led away by such an advertisement, to make the necessary tests for themselves, or, at any rate, endeavouring to guide them in selecting fowls which would most likely prove most remunerative as egg-producers.

I may say at once that so far as my experience goes, and I make the statement after very careful consideration, the variety has not yet been produced which, as an egg-producer, equals the best egg-producing varieties, and, as a table-bird, equals the best table varieties. Moreover, the efforts to effect this much-to-be-desired combination have, so far, only resulted in modifying both qualities, as represented in the parent stocks. This statement is made without the slightest desire to decry or to hamper the laudable efforts of breeders to produce such an ideal bird. These gentlemen have my warmest sympathy, and are at all times welcome to such assistance as I may be able to afford.

It is well known to all poultry-breeders that a marked difference in the number of eggs produced is shown by different birds of the same variety. A similar phenomenon exists amongst cows as regards both quantity and quality of milk—in fact, the qualities for which any variety or breed may be noted vary considerably as between specimens of the same variety or breed. This being known, it will be seen, as I proceed, how simple it would be for a breeder, desirous of showing the supposed superiority of one variety over another, to ensure the success of his particular fancy. Take the case of a man who has a large stock of Leghorns, and is desirous to show, by means of a regular test, that Leghorns are the best layers. The test might be against an equal number of either Minorcas or Andalusians, both of which, it will be readily admitted, are well known to be excellent layers. Relying on the fact mentioned above, he would select from amongst his flock of Leghorns (say) six hens which are remarkable as layers even amongst their fellows. With the other two varieties mentioned he would select six each of hens of less productive dispositions. When the three pens were made up the best judge in the world would be unable to detect anything wrong, and the feeding and keeping of the record might safely be left to an absolutely unbiassed person. There is, of course, no doubt as to what the result would be under such circumstances. The Leghorns would come out easy winners, and the result could be blazoned forth in every newspaper in the country.

I readily admit that with regard to the three breeds mentioned, a result favourable to either breed, and the consequent purchase of birds of the winning variety, would not prove a very serious loss. My chief object, however, is to show how much depends on selection as well in the case of fowls as in everything else; and, also, that tests of this character should be carried

out by some responsible man, whose sole desire is to ascertain which variety possesses the required characteristics, and who has nothing to gain by the victory of any variety. It was for this reason that we published (Vol. III, Part 12, p. 1027) the tests carried out by Mr. Gilbert of the Ottawa (Canada) Agricultural-experiment Station, in preference to the tests of any private breeder.

There is another phase of the question, which is of considerable importance in a country like New South Wales, possessing, as it does, such a variety of climates. Experience has shown that different breeds of fowls do better in some parts than in others, and only in a few instances has any breed been found to do equally well in the extreme heat, the temperate, and the extreme cold. It is hardly necessary, perhaps, to mention that a hen only does herself full justice as an egg-producer when in perfect health. No hen will be in perfect health in a climate which does not suit her; and, as a consequence, she will fall off in the number of eggs she produces. Without offering any definite advice on the subject, I venture to suggest that of the three varieties mentioned as egg producers the Andalusian will be more likely to do well in a hot, dry climate; the Leghorns in the extremely cold districts; while all three of them do well in the temperate portions of the country. In each case, however, it must be understood that the suggestion implies proper attention, *i.e.*, variety in food, plenty of clean fresh water, shade from the midday sun, and dry, comfortable roosting-houses, as protection against cold and wet. Add to this the little necessaries in the shape of crushed bones, lime, and general cleanliness; and, even if your birds do not break the record, they will, at any rate, return a handsome profit on outlay both of time and money.

In the April issue I propose dealing with table-fowls, as opposed to layers; and as opportunity arises the various well-known useful breeds will be illustrated and described. Meantime I should be glad to receive the experience of breeders and poultry-keepers in the extremely hot and extremely cold portions of the Colony, both as regards the breeds I have mentioned in this article, as well as any other breed they may have found to do well under their particular conditions.

Note.

Roup.

I HAVE noticed that fowls constantly contract roup, the most fatal of poultry diseases, on being transported any considerable distance. As the breeding-season approaches such transportations will become numerous, so that a few words as regards the most effective remedies may be useful. Of course there is nothing like prevention as far as possible, which desirable object will be greatly assisted by keeping the roosting-houses scrupulously clean—sprinkling unslaked lime over the floor and thoroughly lime-whitening walls, perches, and nest-boxes. The first signs are slight running at the nose, then heavy breathing and an occasional sneeze. The two later symptoms can best be detected by a visit to the fowl-house in the evening. Any bird so affected should be immediately removed to hospital, and given a small quantity of Epsom salts. In the morning, a piece of camphor, about the size of a French bean, should be administered, and all food given should be soft. Where the breathing is very heavy the nose should be syringed through the roof of the mouth with weak Condy's fluid. The hospital should be dry but airy. Unless the bird attacked is valuable it is much better to kill and bury it at once, and see that all drinking-water utensils to which the bird has had access are thoroughly washed out before the other fowls can get at them.

(4.) On the establishment of an Expert Department of Agriculture in New Zealand.*

By W. M. Maskell, F.R.M.S.

Mr. Maskell said that, because there was a gentleman in the Cabinet with the title of Minister of Agriculture, and under him a Department of Lands and a Department of Stock, most people in the Colony were under the impression that there is in New Zealand a Department of Agriculture properly established. This, however, was not the case, the title mentioned being practically (except, perhaps, for stock) misnomers. In point of fact, there is not at present in the country any official and responsible machinery for investigating the various enemies to cultivation, and for informing and advising cultivators thereon. Agriculture, he might say in passing, was not necessarily farming; there are large numbers of persons engaged in, or interested in, gardening, tree-growing, fruit-growing, floriculture, cultivation of all sorts, who are not farmers, and this should be borne in mind, as will be presently mentioned.

Now, on the appearance of a new enemy to the cultivator of a new pest amongst crops, or trees, or gardens, or even of a new friend, or a new method of procedure, what has to be done by the existing machinery? There is nobody in the Colony placed in an official and responsible position, and the so-called Minister of Agriculture has to go outside his department and obtain amateur advice. Take, for instance, the "Tauranga Sheep-disease," as it is called: professors of different colleges are sent for, to investigate it, and that is not a college professor's duty. Take the Hessian fly: an official in the post-office, who happens to be an excellent entomologist, is sent up to attend to it. Take the so-called "blights": recourse is had to an officer of the University; and, when a friendly beetle comes to help men to fight these "blights," again the University officer is appealed to. In such cases as the appearance of the horse bot-fly in Canterbury and Auckland, or the fear of some fungus-pest injurious to apple-growers, there is no official responsible person to whom the colonists can go for advice or help. It is not a question of ability, or of desire to be useful. All the persons just named have, no doubt, always been glad to assist, and would always be ready to give the Government and the country their very best services, and, undoubtedly, the advice tendered by them has been thoroughly honest and well considered, but it is essentially and necessarily amateur and irresponsible, and what is wanted is the stamp of an expert official who can command rather than deserve public confidence. It is no disparagement of the gentlemen who have hitherto been called in as advisers to say that an expert department would be far more satisfactory, and produce better results.

* Paper read before the Wellington (N.Z.) Philosophical Society, 29th July, 1891.

In other countries people have realised this fact, and have established expert agricultural departments. In the United States there is the central office at Washington, and, besides that, nearly every State of the Union has its own. In England there is the Board of Agriculture, with a professional staff. In Australia, the three colonies of New South Wales, Victoria, and South Australia have expert departments; so has India. The author exhibited to the meeting specimens of the periodical publications of some of these—the "Insect Life" of the Washington office; the *Agricultural Gazette* of the Sydney Department; the "Indian Museum Notes" of Calcutta; the Reports of the State Boards of New York, California, Nebraska, Iowa, and others. One thing was especially noticeable about all these (which were issued at short intervals, some monthly), and that was, that they were especially adapted to the circumstances of the country they appeared in. Now, in New Zealand we have nothing, or almost nothing, of the kind. The Government lately issued a little pamphlet about the phylloxera and other vine-diseases; it is good enough as far as it goes, but it is nothing more than a compilation from facts known in other countries, and does not specially apply to New Zealand.

Two things ought to be very earnestly borne in mind in considering this question. One (noticed above) is that the department required must deal not only with farmers, but with all sorts of persons interested in all sorts of cultivation; it results from this, that a mere "practical farmer" would be entirely insufficient to direct it. Independently of the general disinclination of the "practical farmer" to look an inch beyond his nose, a much wider and deeper knowledge is necessary than he is at all likely to possess. Secondly, the department must deal with every kind of friend or foe to cultivation. Animal foes, such as insects, are not always more destructive than vegetable foes, such as the various fungi or noxious weeds. Consequently, the department, if not the officer in charge of it, must be two-sided. In New South Wales and in Victoria, and in the United States, the various Boards include separate staffs of entomologists and botanists. It is, of course, difficult for any Minister in New Zealand to pluck up courage enough to tell Parliament that two salaried officers are wanted. But he might, at least, start with one; and the author, in a letter sent lately to the Minister for Lands, strongly urged that in England an officer could be obtained competent to at least make a good start with a department, and sufficiently expert in economic entomology and in economic botany. The suggestion made in the letter was that (say) the Royal Agricultural College at Cirencester should be applied to, or Professor Wallace, of the Edinburgh University, to recommend such an officer.

Complaints are sometimes made that the subjects treated of at meetings of the Society are not sufficiently practical. Well, here, at least, is a practical question demanding a practical solution. Whether the solution would be given by the Government and the Parliament might or might not be likely; at all events, it was good to put on record the opinions just expressed; and the speaker trusted that the Society would endorse them by passing the resolution which he proposed, if his views were considered to be correct, to move, namely, "That, in the opinion of this Society, the establishment of a fully-equipped expert Agricultural Department is urgently required in New Zealand."

General Notes.

Gumming in Fruit-trees.

Description.

The term "gumming" has been applied to the loss of sap which occurs through the bark cracking or breaking away from causes other than accidents.

Cause.

It is supposed to be due to constitutional weakness of the stocks; but as this has not yet been determined with certainty, it is desirable to carry out investigations and experiments with a view to determining the true source of the trouble and the best remedies.

Investigations and Experiments.

The following are recommended as having been found more or less useful:—

1. Avoid narrow angles in the pruning; the growing together of vigorous branches (or branches and trunk), situated so as to come together at a small angle, tends to cause gumming at the crutch.
2. Remove gum, as it ultimately causes the bark over which it flows to decay.
3. If gumming occurs, cut away with a sharp tool until clean wood and healthy bark are reached, and cover the cut with shellac dissolved in alcohol to the consistency of paint—rubber paint or grafting-wax.*
4. Secure good drainage.

Observations.

The Department will be glad to receive answers to the following questions on points of interest in connection with gumming in fruit-trees:—

1. Have any of the treatments above recommended been found effective?
2. Have any other modes of treatment proved of value?
3. What stocks are those which generally gum?
4. Information as to any other point considered of interest will be acceptable; and specimens of gumming are specially requested for investigation in the Department.

(*Name*)......................
(*Address*)....................

* A very good grafting-wax is made as follows:—Take 1 lb. mutton tallow, 2 lb. bees'-wax, 4 lb. resin, mix together by means of heat, and see that the mixture is kept hot enough to be plastic, but not hot enough to run.

AN INEXPENSIVE METHOD OF STORING LEMONS.

THE following experiment, carried out by Mr. A. H. Benson, fruit expert of the Department, will be of considerable interest to growers of lemons who find, as is very often the case, the market in such a glutted state that the price offered for their fruit is too low to repay cost of cultivation, and the only course that is open to them is to hold over their surplus crops until a more favourable opportunity occurs for disposing of the fruit at a remunerative price.

On 4th August, 1892, Mr. Benson cut at the orchard of the late Mr. E. H. Acres, Dural, a case of lemons. They were carefully handled, and allowed to remain in the case in Mr. Acres' granary till the 19th August, when they were wrapped in tissue-paper and forwarded to the Department. On 26th August the box was placed on the ground in one of the store cupboards at the rear of the Department's offices. One division of the case was examined from time to time, but the other division was not opened until the 11th January, twenty-three weeks from time of cutting, when three lemons were found to be rotten, and the rest of the fruit had shrunk at least one-third in bulk. (These lemons were not a good sample when gathered, being more or less coarse-skinned, and were also somewhat over-ripe for really good curing.) The fruit remaining in the box such a long time was in itself a very severe test, and to this must be added the fact that no means were used to keep the temperature down, or to regulate ventilation, the store-cupboard used being by no means perfect in the latter respect.

Although the fruit had a somewhat shrivelled outward appearance, the change only extended to the rind, and neither the flavour nor the juiciness was in any way impaired. Doubtless, many readers of the *Gazette* in the Cumberland district have seen a sample of the lemons that the Department forwarded for the opinion of the Fruit-growers Union of New South Wales.

THE BENEFITS OF BARE-FALLOWING.

A VERY striking instance of the benefits to be derived from a judicious system of bare-fallowing for wheat has come under the notice of the Department, and the particulars are now published for the information of wheat-growers whose land, through excessive cropping, does not yield a fair return for labour expended in cultivating it. In November last, Mr. W. Carpenter, of Cowra, in writing to the Department on the subject of destroying weed-pests, stated that he had found summer fallowing most useful in this respect, and that during 1891 he had fallowed a wheat-paddock of 20 acres, which he had ploughed twice and scarified five or six times. Not only did this working of the land rid it of undesirable weeds and black oats, but Mr. Carpenter estimated that, as a result of bare-fallowing, the paddock would yield at least 8 or 10 bushels more than parts of his land which had not been treated in this way.

From particulars of his harvest, just received, we learn that Mr. Carpenter's estimate of the additional yield was a low one, there being stripped from the fallowed land 31 bushels per acre, while from land that had been allowed to lie idle, but had not been worked, only 17 bushels to the acre were obtained. Mr. Carpenter calculates the value of his wheat at 3s. 6d. per bushel; thus the 14 bushels extra from the fallowed land would give a return of £2 9s. per acre more than from the rest of the land. Then, as

Mr. Carpenter points out, this is not the only pecuniary advantage to be derived, for if both plots of land were sown again in the coming season, he would expect at least 5 to 8 bushels more to the acre from the worked land than could be expected from the unworked plot.

He has furnished the Department with the following approximate figures regarding cost of bare-fallowing a paddock of 20 acres;—

Ploughing twice, scarifying four times, rations for men, wear and tear of shares and harness, &c. £9

so that deducting this sum from the amount obtained for the extra yield of 14 bushels per acre, there is an extra return of £40, or £2 per acre. Of course, the cost of ploughing, &c., given may be considered too low, and the price of the wheat is too high at present rates; but still, after making all allowances, it can readily be seen that the advantages of the system of bare-fallowing are sufficient to commend it to our wheat-growers as a means of obtaining the best results from their land.

Experiments with Fertilisers at Orange.

Growers of oats will doubtless be interested in the following particulars of some interesting experiments in the use of different commercial fertilisers that have been conducted during the past season at Orange, by Mr. J. H. Gain. In June, 1892, Mr. Gain selected a paddock comprising 5 acres which had been lying fallow for eight years, and sowed the whole area with oats of one variety. When the crop had attained a height of 4 inches, the paddock was marked off into 1-acre blocks, and to the best acre patch in the paddocks, called No. 1, no manure at all was used, while to Nos. 2, 3, 4, and 5, respectively, a top dressing of nitrate of soda, blood, and bone-dust, sulphate of ammonia and nitrate of soda, and of sulphate of ammonia was applied.

The crop on No. 1, unmanured land was stunted, the yield being about 14 cwt. of hay.

On No. 2, top-dressed with 50 lb. nitrate of soda, which cost 13s., the crop was about 1 ton of hay.

From No. 3, top-dressed with 2 cwt. of blood and bone-dust, at a cost of 11s., a yield of about 1 ton 10 cwt. was obtained.

No. 4 plot, dressed with a mixture of 44 lb. sulphate of ammonia, and 20 lb. nitrate of soda, costing altogether 12s., yielded about 1 ton 15 cwt. of hay; while the last plot, No. 5, to which had been applied a dressing of sulphate of ammonia, costing 13s., gave a return of about 2 tons of hay.

In connection with these tests, it is to be regretted that the exact weight of the crops taken from the different plots are not available, Mr. Gain only having estimated the amounts as nearly as possible. Still these experiments are conclusive evidence of the great advantages to be derived from the use of a suitable fertiliser, and of how well the outlay is repaid by the increased crop value.

Although the results obtained by Mr. Gain from the application of sulphate of ammonia are highly satisfactory, as compared with those from the unmanured plot, it must be borne in mind that this manure used alone will exhaust the soil of its mineral constituents, and in order to counteract this the Department advises the mixing of superphosphate with it.

Nitrate of soda at present prices is too dear for practical purposes as a fertiliser. It is worth only £10 a ton, compared with sulphate of ammonia

at £13. We would recommend farmers interested to test the results from equal values of Sugar Company's No. 2 manure, sulphate of ammonia, dried blood alone, and dried blood and bone-dust; the two first mentioned to be applied to the crop in early spring, and the two last named to be sown with the seed.

Bordeaux Stirabout as a Preventive of Potato Disease.

The prevalence of the disease in potatoes throughout Great Britain and Europe during the past season has excited the attention of many prominent agriculturists, and the following brief account, from *The Kentish Mercury*, of some experiments recently conducted by Messrs. Carter and Sons, on the lines of the experiments so successfully carried on by Dr. Aimé Girard, in France, for the last six years, may be of interest to growers of potatoes in this Colony. Dr. Girard's report was so satisfactory that Messrs. Carter resolved to test the efficacy of his treatment in England, and laid out an experimental plot of 1 acre. The mixture required for this area of potatoes is made up of 22 lb. sulphate of copper, 22 lb. unslaked lime, and 100 gallons of water (the sulphate being of the Macclesfield Patent, and of the standard of 98 per cent.). This mixture, which must be constantly stirred, is sprayed upon the potato haulms as soon as, or preferably before, the potato fungus gives signs of its presence, and, if necessary, the application is repeated. The cost is, roughly, 20s. per acre.

On 8th April, 1892, rather less than an acre of potatoes was planted in ten long double rows, the drills being exactly a yard apart—a distance which in England is found to pay better than if the tubers were more thickly planted. The ten varieties chosen were all of acknowledged excellence, including the Imperator, which this Department has recently introduced; and were so selected that they ripened in succession. The ground was divided into four equal parts, of which the first and third were dressed with the mixture on the 11th July and 2nd August, respectively, and the second and fourth left undressed. The mixture was applied by a spraying-machine.

On 27th and 28th August there was a heavy fall of rain, with simultaneously a wide change in temperature; and in the first week of September it became clear that disease was ravaging the undressed plots.

In the second week of September the rows were dug up, and the affected tubers carefully separated from the sound ones, and the weights of each noted. Whilst the haulm was naturally browner and more withered in the earlier than in the later varieties, it was very obvious that on the dressed plots it was greener, more vigorous, and had retained its vitality longer than was the case in the plots that had not been dressed. Still more convincing were the recorded weights of the tubers as to the value of the dressing. In the first of the dressed plots, of 35 cwt. 0 qr. 18½ lb. of tubers, only 8¼ lb. were found to be diseased. In the other diseased plot, of 23 cwt. 0 qr. 3½ lb., only 2¾ lb. were affected; while in the undressed plots, of 32 cwt. 3 qr. 3 lb., and 20 cwt. 2 qr. 23 lb., not less than 3 cwt. 2 qr. 11 lb., and 3 cwt. 1 qr. 11 lb., respectively, were diseased.

It will be of interest to note that on the undressed plots the earlier sorts yielded a greater quantity of bad tubers than the later kinds. The heaviest yield of the whole series was obtained from a row of the Imperator variety, dressed with the Bordeaux stirabout.

Fruit-fertilisation by Bees.

Nothing in nature is more astonishing than the fertilisation of flowers and fruits by bees. There seems to be the closest sort of relation between these insects and the vegetable world, the latter depending on them to an enormous extent for the propagation of its species. Darwin and Gray have both written entire books upon the wonderful way in which orchids of various kinds are fertilised by bees that carry pollen from one blossom to another. One sort was discovered by the latter writer to absolutely require a fight between two bees in order that its own fertilisation should be accomplished, one bee entering a small tunnel at one side at the same time that another comes in at the opposite end, the consequence being a scrimmage, in the course of which the pollen grains which they brought on their bodies are scattered upon the stigmas. If it were not for bees the orchards and fruit-gardens would be largely barren. Take the apple, for example, which, from the botanist's point of view, is five fruits in one, demanding for its perfect development the fertilisation of five independent pips or ovules. Now and then one will come across an apple that is shrunken on one side, which means that one or two of the ovules have missed fertilisation. This work is performed chiefly by the bees, as they go about from tree to tree gathering honey from the blossoms, and at the same time conveying the pollen from one blossom to another. In the case of the strawberry, for each little fruit there must be from 100 to 300 distinct fertilisations, in order that it shall attain perfection, and this task is performed by the bee as it sucks nectar from the original flower. If any stigmas remain untouched by pollen, the strawberry in that spot remains hard and shrunken, even when the fertilised portion is fully ripe. Thus it appears that the honey stored away by bees is, from the point of view of mankind, only a very small part of the value which they produce. There are ever, so many superstitions about bees. In some countries it is customary to drape the hives in mourning when the owner of them dies, and elsewhere it is the practice to go through the ceremony of telling the bees that their master is dead. Is it not Whittier who wrote that exquisite piece of verse entitled "Telling the Bees"? In that poem this curious and interesting custom is described. When their owner dies, it is supposed, in some localities, that the bees follow him to the grave, a notion which seems to be derived from the fact that these insects are apt to alight on the fresh varnish of the coffin, their object in so doing being to gather a substance that will be valuable for varnishing their cells. In Sicily and many other countries it is regarded as very bad luck to sell bees for money. They must be traded for, if possible, with sheep, although the purchaser may go at night and leave cash for a hive secretly, taking the latter away at the same time.—*Horticultural Times.*

Propagation of Native Grasses for Seed.

Judging from the numerous requisitions that have been made to this Department for seeds of our native grasses, it would appear that the pastoralists of not only America, but of Europe and India, are now fully aware of their varied character and nutritious properties, and are very desirous of introducing some of them to supplement their own pastures. Several of the leading seedsmen of Sydney have brought under the notice of the Department orders for these grasses that they have been entrusted with from America

and other places. These orders could not be executed, however, as the seeds are not a marketable commodity at present.

In view of the fact that many of our farmers and graziers have failed, after great expense and trouble, to grow English grasses satisfactorily, and are constantly applying to the Department for seeds of the best of the native grasses, the Minister has approved of provision being made at the Hawkesbury Agricultural College Farm, and at the proposed experimental farms at Wagga Wagga, Uralla, and the Richmond River, for the cultivation of the best of the indigenous grasses, for the purpose of providing seed for distribution to our farmers and pastoralists. These experimental plots will be cultivated under the personal supervision of Mr. F. Turner, Botanist of the Department.

Crowfoot (*Erodium cygnorum*, Nees).

During a visit of inspection to Junee, Mr. J. Stephenson, of the Department, saw a very fine half-acre plot of crowfoot (*Erodium cygnorum*), which Mr. Bourke, manager of the Millbank and Clear Hills properties, was growing for seed.

This native fodder-plant is illustrated and described in the Botanist's work on "The Forage-plants of Australia." It is considered a most valuable fodder, and all kinds of stock are remarkably fond of it.

Contributions to the Museum of Economic Botany.

The Department has received from Messrs. Sutton and Sons, the well-known seedsmen of Reading, England, for exhibition in the Museum of Economic Botany, a collection of English grasses beautifully mounted, with full particulars as to feeding value in Great Britain and the amount of seed necessary per acre. Also a number of excellent models of roots, principally mangolds, turnips, and different kinds of carrots and parsnips, show the true forms of the best varieties now grown in England. These models serve to illustrate to what a state of perfection roots have been brought in the old country.

The Maize Moth (*Heliothris armigera, Hüb.*).

The destruction caused to maize crops by these caterpillars has, since their appearance at the Hawkesbury College Farm, been reported from Moss Vale and other places. Mr. Helms, of the Department of Agriculture, visited Moss Vale, in consequence of the reported presence of the insect, and in his report he mentions the fact that the chief destruction occurs in the heart of the plant, the insect hiding between the coils of the young leaves. Such leaves form a funnel-like receptacle, which becomes filled with excreta, so that if the larvæ do not actually consume the leaves this excreta must have a depreciating effect on them. Mr. Helms says:—"The larvæ are no doubt those of *Heliothris armigera* (which has already been illustrated and described in the *Gazette*, Vol. 1, Pt. I, p. 125), and as they seem to me about to pupate at the present time, or in the near future, there will probably soon be a brood of immense numbers ready to lay eggs." As the crops in connection with

which this was written were intended for silage, Mr. Helms points out that a large number of these eggs would be destroyed during the fermenting process which the silage undergoes.

In his report, dated 19th instant, Mr. Olliff, Entomologist to the Department, says:—"These caterpillars are certainly identical with those which have done so much damage at Richmond and elsewhere. From an examination of a moth bred, yesterday, from pupæ obtained by Mr. Helms, and a comparison of the caterpillars from various localities, I have convinced myself that the insect is the maize moth (*Heliothris armigera*). Three or four broods are known to occur in a season, and the species is almost omnivorous, eating tomatoes, tobacco, many kinds of grasses, &c., &c."

As regards remedies, those recommended in the *Gazette* referred to include ploughing in cold climates to destroy hybernating chrysalids; early planting and forcing to early maturity, so that the ears may become hard before the second brood makes it appearance. Hand-picking, and the use of pyrethrum extract, diluted with water in the proportion of one to thirty. In addition to the above, the ploughing of a deep trench round a cultivation paddock will prevent the ingress of numbers of caterpillars, which, in attempting to climb out of the trench, bring down the loose sides and bury themselves. Spraying with Paris green is by some authorities considered the best means means of suppressing the pest.

Disastrous Hailstorm at Richmond.

A report has been submitted to the Minister for Mines and Agriculture, by the Principal, regarding the injury done to the crops at the Hawkesbury Agricultural College Farm by a hailstorm which passed over Richmond on January 18th last. This hailstorm, though it lasted only for a very short time, damaged the crops—nearly all in an advanced stage—not only at the College Farm but throughout the whole district, to an extent which seems almost incredible, and illustrates only too well the uncertainty of farming operations in the face of calamities like this, which no human foresight can guard against or prevent.

The farm overseer, in reporting the matter, states: " * * The storm swept across the common with great fury, accompanied by hailstones of extraordinary size; and for forty minutes it raged without any intermission, leaving a track of ruin where everything had been looking so well. The storm was of a very local character, and appeared to be in two divisions, most damage of course being done in the centre of each. It was extremely fortunate that after the first burst the wind lulled somewhat, as great loss of animal life must have resulted; as it was, large lumps were raised on the horses by the hailstones, the men also suffering severely. The calamity has been a double misfortune to us, the season being too far advanced for a second sowing of maize, pumpkins, or melons."

It is estimated that one maize crop of 40 acres has been damaged to the extent of 80 per cent., another crop of 50 acres 20 per cent.; 25 acres of pumpkins and melons, with 3 acres of early melons fit for market, were totally destroyed, while all that remains of a 10-acre patch of maize for ensilage is 30 per cent. The hay and straw stacks have also been considerably injured by the violence of the storm.

The orchard manager reports that the fruit-trees in the orchard and nursery, as well as the grape-vines, suffered severely. The fruit-trees,

however, being young, will recover from the effects of the storm sooner than older ones. Three acres of melons and 2 acres of pumpkins, besides all the vegetables grown in the orchard for college use, have been completely destroyed.

The total damage done to the crops on the farm and orchard is estimated at not less than £800.

Caper Spurge.—A Poisonous Plant.

Several specimens of a plant commonly known as the "Caper Spurge" have been brought to the Department for identification. It would appear that in many instances the fruits of this plant have been mistaken for the caper of commerce, as several persons in forwarding the "Caper Spurge" have asked for instructions with a view to conserving the so-called "capers." Instances are rather too common of persons having eaten this poisonous "caper," and who, as a consequence, have experienced a severe burning sensation in the mouth and throat followed by serious illness. The botanical name of the plant in question is *Euphorbia lathyris*, Linn. It is a native of southern Europe and west central Asia, and probably also of the southern counties of England. It has long been cultivated in Australian gardens, and may now be found growing as a weed in several parts of the Continent. It is a tall, stout plant, often over 3 feet in height, smooth, but of a glaucous colour. The leaves are opposite, those on the stem are narrow oblong, often 3 to 5 inches long, shining green above and pale underneath; the upper leaves are much shorter and broader, especially at the base. The flowers are of two sexes and are arranged on axillary stalks. The female flowers are succeeded by pale green smooth fruits about half an inch in diameter, each fruit being composed of three carpels (divisions or cells) containing a single wrinkled seed. The whole plant abounds in a purgative milky juice.

The above description has been given in popular terms with a view to enabling the public to recognise the plant without difficulty, and of preventing danger to health arising from the mistaken idea that the fruits are the capers of commerce.

Diplomas in Agriculture.

On Saturday, the 11th inst., the diplomas in Agriculture in connection with the Hawkesbury Agricultural College were presented to the successful students by the Hon. T. M. Slattery, Minister for Mines and Agriculture. It is a matter for congratulation that these diplomas were gained as the result of the satisfactory answers given to examination papers prepared by the several principals of the Victorian and South Australian Agricultural Colleges, the diplomas being awarded on the reports of these gentlemen. This fact not only adds to their value, but speaks highly for the thorough training imparted by the college curriculum. The following are the names of the eight students who comprise the first batch of those who have brought their college course to so successful an issue:—Henry Shute, Elliot J. Rien, Arthur Moore, Mark H. Reynolds, F. L. Nott, Herbert J. Dark, P. G. Wicken, and Gilbert Wright.

Levures for Fermenting Wine.

Steps have been taken by the Department to conduct experiments on a large scale in wine fermentation by means of pure, selected levures or yeasts, similar to those which have been so successful in France, California, and Algeria, as to bring these levures into common use.

As it will be of advantage that these experiments should cover as wide an area as possible in view of the marked variations in climate in different portions of New South Wales, arrangements were made by the Department by which these levures or yeasts were supplied to several wine makers, who decided to conduct such experiments on their own account.

It should, perhaps, be mentioned that the levures are packed in tins containing sufficient to treat either 100 or 200 gallons of grape juice, and that they should be applied at the time of filling up the vats with crushed grapes, the cost being about 1½d. for every gallon treated.

The following levures are available:—

Bordeaux levures—

For Claret—Chateau Lafite, St. Emilion;
For White Wine—Santerne.

Burgundy levures—

Red—Hermitage and Cote Roti;
White—Chablis.

Rhine levures—

Hock (Johannisberg);
Champagne levure for any delicate wine.

Sherry levure—

Particulars as to the result of experiments will appear in a future issue.

Foot-rot in Sheep.

At the present season of the year, when this painful disease is playing havoc amongst the flocks of numerous sheepowners, both small and great, a few practical remarks, says Mr. W. G. Dowling, Inspector of Stock, may be found of service both in alleviating the sufferings of these useful animals and saving their owners from loss. It is hardly necessary to go into minute details, such as cause, &c. (except to state that it is usually found on rich pastures and where the soil is deficient in lime, and is worst in the autumn and spring) as what is wanted is a cure and one not expensive. Of this and the mode of application I shall speak presently. A great number of the so-called remedies only temporarily suppress, not cure the malady. As this disease is highly contagious, it is always necessary, as a first step, to separate the diseased from the healthy sheep, or otherwise the whole flock is apt to take it—which is very often the case, as I do not know one owner in six who does separate them.

This is quite a recent disease on the Lachlan, from what I can learn, and was very likely brought here in the first instance. In dealing with this complaint, I always found a small yard, littered over with clean straw or grass and wetted, and the sheep placed on it over night the best, and in the

morning their hoofs will be quite soft, so that the greatest and most unpleasant part of the labour, as usually performed, will be in a great measure saved, and they will not be so apt to get dirt between the clefts of the hoof.

The process of paring is the most important factor in aiding the cure. All the ulcerated parts must be entirely denuded of hoof, without making the feet bleed too freely, and to keep the feet as near the natural shape as possible. The next process is to cut off any considerable fungus growth with a sharp pair of scissors or knife or else to cauterise them.

Now what is the best cure ?—Well, I have found nothing simple or compound (and I believe I have used every acid a chemist's shop contains) is equal to sulphate of copper or bluestone, and a solution of this (say) 8 oz. bluestone, 1 gallon of water, made as hot as a sheep can stand comfortable in, placed in a tub or trough capable of holding say about four sheep—and when the fourth one is placed in it take out the first—by this method the whole of the feet get thoroughly saturated, then let them stand on dry battens for a time before turning out. The sheep dressed must be looked to as often as once in three days, so that any bad cases can be washed and redressed, and so the cure will be effected. Once a sheep is thoroughly cured every succeeding attack is less severe if it does occur again.

Another great advantage in bluestone is that it nullifies the matter or virus which exudes from the diseased hoof. A great many owners pin their faith to arsenic, but I can only say after eleven years experience of this disease that arsenic only temporarily allays the complaint, and in a week or two the sheep are as lame as ever.

AGRICULTURAL SOCIETIES' SHOWS, 1893.

Society.	Secretary.	Date of Show.
Castle Hill A. and H. Association...	F. H. G. Rogers	April 3, 4
Wellington P. and A. Society	R. Porter ...	April 12, 13
Liverpool Plains A. and H. Association	F. T. R. Veness	April 19, 20
*Mudgee Agricultural Society	J. M. Cox ...	April 19, 20, 21
Richmond River A., H., and P. Society (Casino) ...	J. T. Tandy ...	April 20, 21
Namoi P., A., and H. Association	J. Riddle ...	April 26, 27, 28
*Dubbo P., A., and H. Association	G. H. Taylor ...	April 26, 27
Upper Hunter P. and A. Association, Muswellbrook ...	P. Healey ...	May 3, 4
Warialda P. and A. Association	W. B. Geddes ...	May 3, 4
Coonamble P. and A. Association...	F. R. Salt ...	May 10, 11
Gunnedah A. and P. Association	F. P. Brigstocke	May 17, 18
Central Australian P. Association...	J. P. Martin ...	May 23, 24
Warren P. and A. Society	F. C. Thompson	June, 7, 8
Nyngan P. and A. Society	....	June 14, 15
Riverina P. and A. Society, Jerilderie	M. Curtin ...	July 25, 26
Gwydir P. and A. Society, Moree...	S. G. Cohen ...	July 25, 26

* These Societies get the National Prizes for 1893. The Clarence P. and A. Society's Show, which was to be held on April 12th and 13th, also the Hunter River Society's Show at Maitland fixed for April 26th, 27th, and 28th, have been abandoned in consequence of the late flood.

[4 plates.]

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THE

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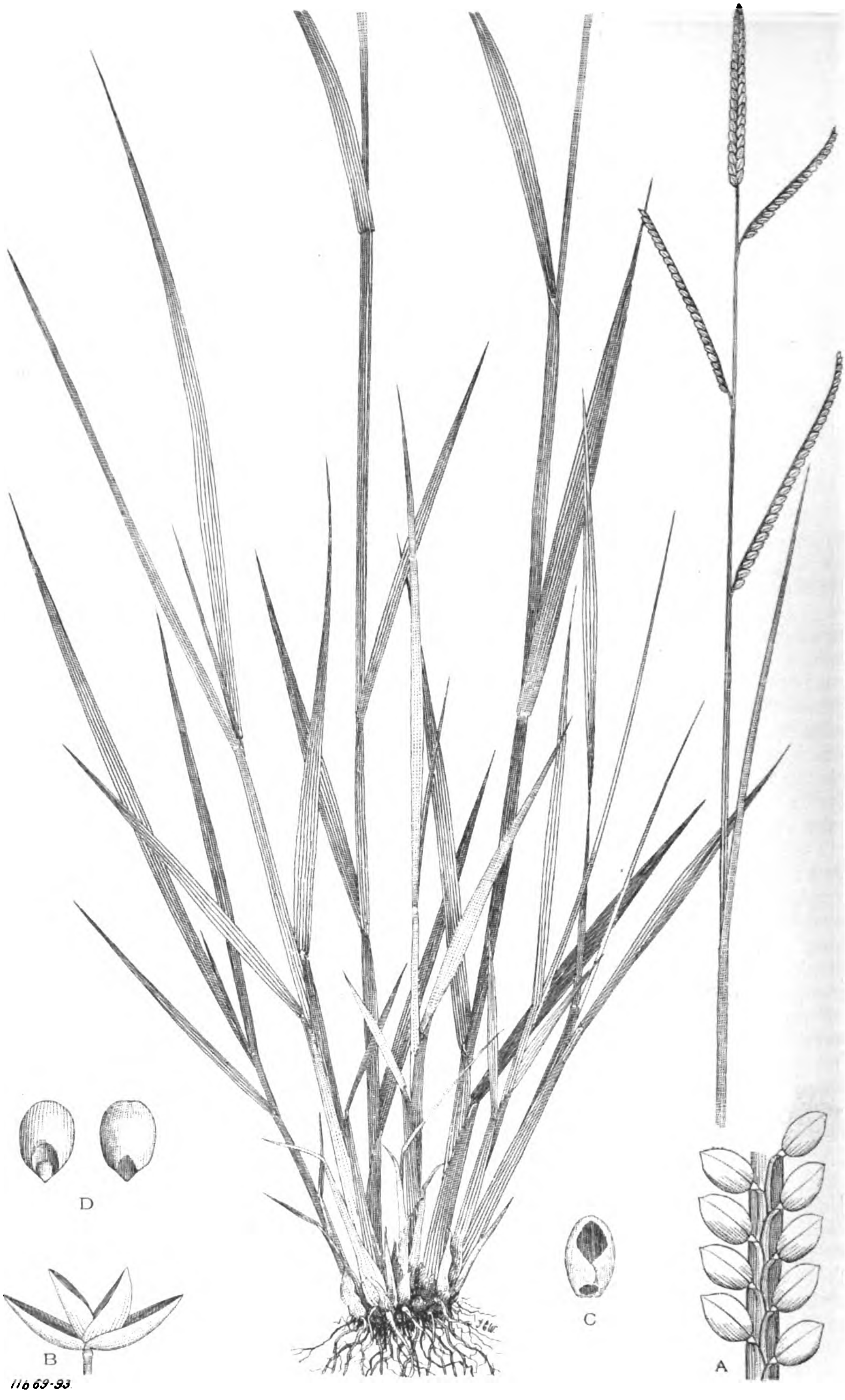


Paspalum scrobiculatum, Linn.

"Ditch Millet."

The Grasses of Australia.

(*Continued from page* 151.)

BY F. TURNER,
Botanist, Department of Agriculture.

PASPALUM SCROBICULATUM, *Linn.* "Ditch Millet."
Flora Austr., Vol. VII, page 460.

ERECT or ascending, attaining 1 foot to 2 feet, glabrous, or rarely with a few long hairs at the base of the leaf blades. Spikes varying from two to five, alternate, spreading, usually distant 1 to 2, or rarely nearly 3 inches long; the rhachis usually flat and about 1 line broad, and sometimes minutely pubescent at the base. Spikelets sessile, or shortly pedicellate, in two close rows, or rarely, in part at least of the spike, crowded into three or four rows, ovoid-orbicular, obtuse, flat, about 1 line long when in fruit. Outer empty glumes thinly membraneous, with a prominent midrib, sometimes minutely pubescent. Fruiting glume similar in shape but soon hardened, very finely striate, the central nerve visible only in the young state. Palea hardened like the flowering glume, the inflected margins dilated at the base into broad hyaline auricles enveloping the flower. Grain enclosed in the hardened palea and flowering glume, and free from them.

A perennial species found in the coastal districts of New South Wales, Queensland, and North Australia, and, according to Mr. Bentham, it is found also in tropical and sub-tropical Asia and Africa. In this country it is mostly to be found growing on the banks of rivers or creeks, or on low-lying moist land. In some places it is very plentiful, and in favourable situations it grows into large tussocks. It is of little value as a pasture grass, and, except during the early summer, or when the herbage is green and succulent, cattle will seldom or never eat it, even if other vegetation be scarce. During the autumn months the inflorescence of this grass is frequently affected with a fungus which forms a soft, dense, black substance. It is known to scientists as *Cladosporium herbarium*, Link. It is seventeen years since I first saw this fungus on the "ditch millet," and, from subsequent observation, it appears to be more prevalent in wet than in dry years. What seed this grass does produce, and it is sometimes a great quantity, usually ripens during the summer and autumn months. Dr. Watt (India), speaking of this grass, says:—"It is a rainy-season crop, yielding, a coarse kind of grain, used mostly by the poorer classes of people. Cattle should be prevented straying into the fields when this crop is ripening, as the grain, until it has been washed several times, is most unwholesome. The straw is sometimes given to cattle." Mr. Duthie (North-Western Provinces and Oudh, India) says of this grass, "that it is the most largely-grown of

all the lesser millets, being a favourite crop for inferior out-lying land. He adds that it is not a popular article of food; the yield may amount to 10 or 12 maunds per acre, but much of this is chaff."

Professor Church gives the following analysis of the grain of this grass, and makes the following remarks on it:—"Composition of Koda millet (husked)—

	In 100 parts.	In 1 lb.
"Water	11·7	1 oz. 382 gr.
Albuminoids	7·0	1 ,, 52 ,,
Starch	77·2	12 ,, 154 ,,
Oil	2·1	0 ,, 147 ,,
Fibre	0·7	0 ,, 49 ,,
Ash	1·3	0 ,, 91 ,,

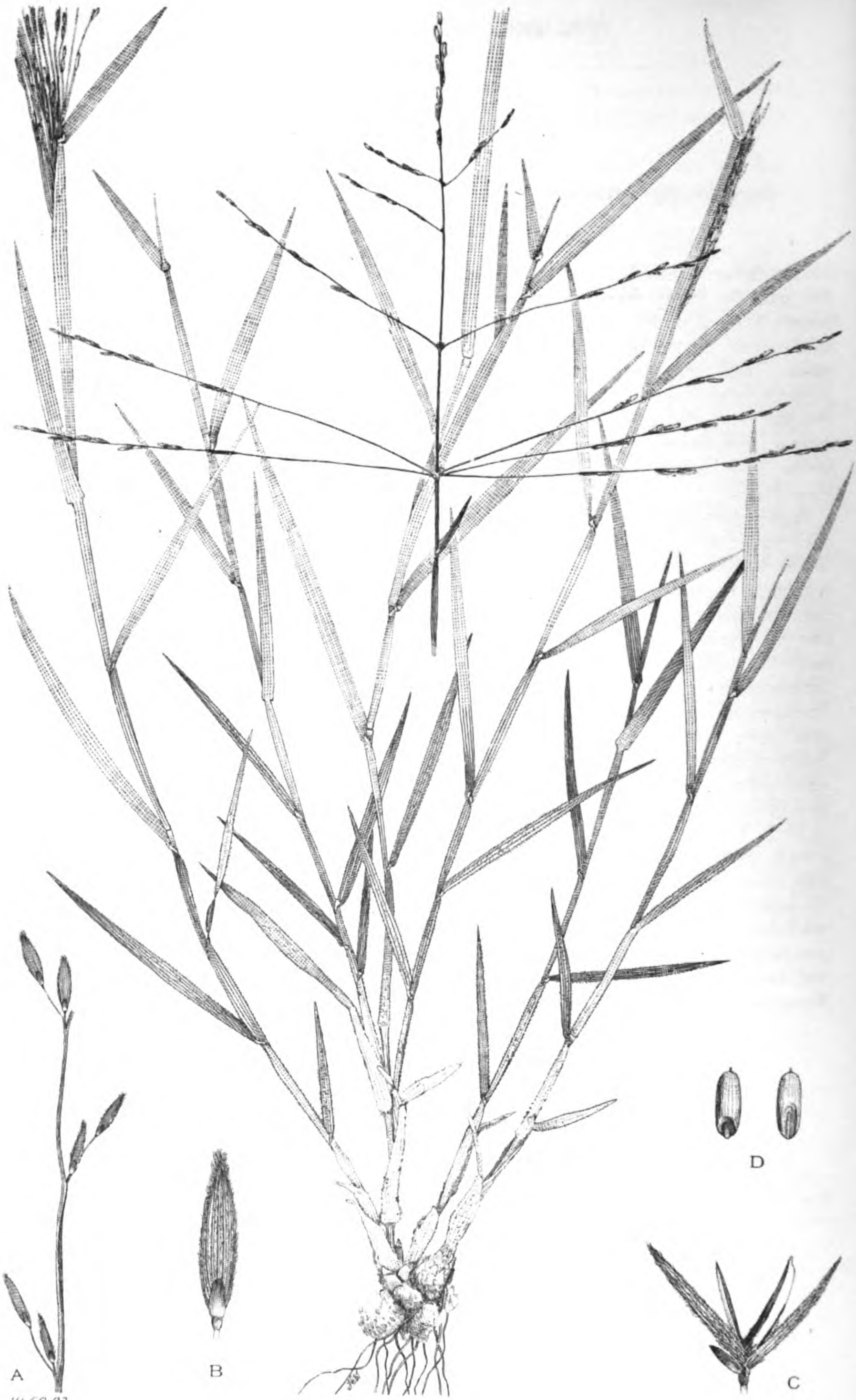
"The nutrient-ratio is here 1 : 11·7, and the nutrient-value, 89.

"It is said, apparently with truth, to be at times the cause of vertigo, and is not considered to be as digestible as *Setaria italica;* the stems afford an inferior fodder. Koda is boiled and eaten in the same way as rice, or else is parched and ground, the meal being made into a kind of pudding. The alleged comparative indigestibility of this grain cannot be attributed to its percentage of fibre, which is usually low, but must be owing to some constituent or some condition of the grain which ordinary chemical analysis does not reveal."

Dr. Lindley (*Vegetable Kingdom*, p. 113), speaking of injurious grasses, says, "and a variety of *Paspalum scrobiculatum*, called Hureek in India, which is, perhaps, the Ghohona grass, a reputed Indian poisonous species, said to render the milk of cows that graze upon it narcotic and drastic. . . The Meyna or Kodro of India, a cheap grain, regarded as wholesome, is another variety of this species."

An allied species, *Paspalum dilatatum*, Poir., which is indigenous in the sub-tropical parts of North and South America, has now become naturalised in several places in this country, more especially in the coastal districts. During the past two years a number of specimens have been received for identification, and they were mostly accompanied with notes to the effect that it was an excellent forage grass, and that it keeps green during dry weather. It is a perennial, and grows taller than the Ditch Millet. I have seen it nearly 4 feet high in the coastal districts, but in drier situations it does not often exceed 2½ feet in height.

Reference to Plate:—A, showing the arrangement of the spikelets on the rhachis; B, a spikelet opened out, showing the three glumes and palea; C, palea, showing the broad hyaline auricles; D, grain, back and front views, all variously magnified.



Panicum cœnicolum, F. v. M.

"Finger Panick Grass."

PANICUM CŒNICOLUM, *F.V.M.* "Finger Panick Grass."

Flora Austr., Vol. VII., page 467.

Stems from a knotty, branching base, ascending to 1 foot or more; leaves flat, usually softly pubescent or villous; panicle of rather numerous slender simple branches 3 to 6 inches long, at first erect, at length spreading, the lower ones verticillate, the upper ones alternate and distant, or rarely in pairs. Spikelets in pairs, one nearly sessile, the other pedicellate, oblong, 1½ to 2 lines long. Outer glume about half a line long, the second rather shorter than the spikelet, five or seven-nerved, the third seven to eleven-nerved, both more or less silky-hairy and empty. Fruiting glume smooth, acute, grain enclosed in the hardened fruiting glume and palea, but free from them.

A perennial species, found in most of the Australian colonies, but nowhere is it reported to be very plentiful, except in the Nyngan district of New South Wales, from where I have received a number of specimens. It is generally to be found growing on rich land that is liable to periodical inundations, though it is met with in drier situations. From its peculiar knotted base the stems often branch out very much, though it rarely grows into large tussocks, nor does it very often exceed 2 feet in height including the inflorescence. The leaves of this grass, and also the bases of the simple branches of the panicle are usually densely covered with short silvery hairs, and from this peculiarity it is easily recognised in pastures. When in flower or seed it might give anyone the impression that it was not of any great value as a pasture plant, as the spreading panicles give it rather an uninviting appearance. Notwithstanding this, however, it yields a quantity of leafy herbage, which is regarded as good feed. It makes most of its growth during the summer months, and often till late in the autumn, and may, therefore, be considered as a valuable addition to the grazing areas of the interior. Where the grass is allowed to grow undisturbed for a time it produces plenty of seed, so that, should anyone desire to bring it under systematic cultivation, there would be no difficulty in collecting a quantity of seed from a small reserved area. The seeds usually ripen during October, November, and December.

Reference to Plate:—A, showing the arrangement of the spikelets on the rhachis; B showing the relative size of the outer glume on the spikelet; C, spikelet opened out showing the four glumes and palea; D, grain, back and front views, all variously magnified.

GLYCERIA RAMIGERA, F.V.M. "Cane Grass." "Bamboo Grass."
Flora Austr., Vol. VII, page 659.

A TALL, glabrous, rigid, almost bamboo-like grass, branched at the base, and often bearing clusters of branches higher up. Leaves convolute and flat, few and short on the flowering stems. Pannicle 4 to 8 inches long, loosely ovate, or, at length, very spreading. Spikelets rather numerous, usually 3 to 5 lines long, with six to twelve flowers, but sometimes longer; the rhachis glabrous. Outer glumes narrow, hyaline, acute, faintly one-nerved; flowering glumes distant, about 1½ lines long, broad and concave, hyaline, three-nerved, the nerves all short, the central one not reaching much above the middle. Grain glabrous, enclosed in the glume and palea, but free from them.

This perennial grass is found in all the Australian Colonies, but, so far as I am aware, only in the interior. Judging by the number of specimens that have been received for identification, however, it would appear to be much more common in New South Wales than elsewhere. It was collected in Central Australia by the recent Elder Exploring Expedition. This species is generally to be found growing in what are locally called "cane swamps" or "clay pans," where it usually develops into large tussocks, the stems from which attain a height of from 6 to 10 feet. Although the principal stems are so hard and cane-like, there are often a number of leafy succulent branches growing from nearly every joint, which cattle greedily feed upon, but whether there is any nutriment in them I am unable to say. The stems are often cut for thatching purposes, for which they appear to be admirably adapted. The seeds usually ripen during November, December, and January.

The following note was appended to some specimens of this grass which the late K. H. Bennett forwarded to me for identification:—"A tall cane-like species, growing plentifully in large detached tussocks in 'clay pans,' or, as they are locally called, 'cane swamps.' Here (Lachlan River district) it is much used for thatching purposes, for which it is admirably adapted. I know of roofs of this material which have been erected for twenty years, and are as waterproof now as when first put up. Stock of all kinds are excessively fond of the seed-heads and the young succulent shoots. It seeds, as a rule, in November and December."

Reference to Plate:—A, spikelet, opened out; B, floret; C, three different views of the grain, all variously magnified.

Glyceria ramigera, F. v. M.

"Cane Grass" "Bamboo Grass."

11b 69·93.

Brassica oleracea acephala, D'C.

"Thousand-headed Kale."

New Commercial Crops for New South Wales.

(*Continued from page* 152.)

By FRED. TURNER.

The Cultivation and Uses of the Thousand-Headed Kale.

(*Brassica oleracea acephala, D' C.*)

Judging from the number of letters which this Department is constantly receiving from all parts of the Colony, asking for information about different forage plants and grasses, it is quite evident that at no previous time in the history of the Colony has this subject occupied so much of the attention of both pastoralists and farmers, more especially dairy farmers. The establishment of butter factories in different parts of the Colony has undoubtedly convinced dairymen of the fact that unless milch cows are regularly supplied with good herbage, they will not yield a great quantity of milk. It therefore becomes necessary, if the industry is to be kept going for many consecutive years, and is to be carried out on successful commercial lines, to pay more attention, not only to pastures and pasture plants, but to auxiliary forage crops also. The latter to be either cut and used in a green state, or turned into ensilage, to supply rich succulent feed during times when other herbage is scarce.

Amongst some of the best auxiliary crops for winter use in the colder parts of the Colony would be the cattle cabbages and kales. These crops are largely cultivated in Europe, and are highly spoken of, after many years of experience, as affording a great amount of nutritious fodder, which does not disagree with any kind of stock. To encourage the cultivation of some of the most suitable of these crops for this climate, the Department, two years ago, distributed a few small packets of Jersey tree kale seeds to some farmers, and where the instructions, issued with the seed, were carried out, the result has been highly satisfactory. Although this crop has only been grown in an experimental way, still the good results obtained will no doubt lead to its being grown on a more extensive scale in the near future in those districts which have been found to be the most suitable for its development.

The thousand-headed kale which is figured in this issue, differs from the Jersey tree kale in its more dwarfed habit of growth, its stems being divided into a number of leafy branches, and in its leaves not being quite so large. It is, however, considered to be more productive to a given area. The thousand-headed kale can be recommended, as an auxiliary crop, to dairy-farmers, living in what may be aptly termed the English climate parts of New South Wales. It is of no use attempting the cultivation of this crop in the drier or hotter parts of the Colony, as it would only lead to disappointment, except, perhaps, under irrigation, but even then, during the summer months, aphides and other pests are often so very troublesome that they would not only be likely to retard the growth of the plants, but also render them unhealthy. As this crop would only be likely to be of the greatest value

to the dairymen during the winter months when other herbage is not so plentiful, the seed should be sown in August or September, according to the state of the weather. In a favourable season, however, if it was desired, an almost continuous supply could be obtained by sowing the seed in spring and autumn. The thousand-headed kale has been grown with great success in Victoria, and seeds are now obtainable at the principal seed warehouses in the Colony.

The following extracts on the cultivation and uses of the thousand-headed kale are from Sutton's *Farmer's Year Book* :—

"*Manures required.*—The lesson to the cultivator is, that in preparing for a kale crop it is necessary to choose a soil containing sulphates, phosphates, soda, and potash salts in considerable quantity ; or, if the soil is deficient in these materials, they must be added in suitable proportions. The lime may be applied separately, should the soil not contain sufficient, but the plant must have it. A deep well-tilled loam will suit this plant admirably, and if the land is adhesive, even inclining to clay, so long as it works freely, there are the conditions for a grand paying crop to start with. Speaking generally it may be said that the lighter the soil, the greater need for abundant manuring, and the stiffer the land, the more the necessity for deep tillage and thorough cultivation, to give the roots ample opportunity of ramifying freely. From twenty to thirty loads per acre of good farm-yard manure will not be too much for this crop. Where farm-yard manure is not available, the following proportions of artificials can be recommended per acre: sulphate of ammonia, 1 cwt. ; kainit, 3 cwt. ; super-phosphate of lime, 3 cwt. The kainit and super-phosphate of lime are best applied mixed at the time of sowing, but the sulphate of ammonia must not be combined with the other manures. The last named article should be got in separately before drilling in seed or transplanting, and, if possible, just prior to a fall of rain.

Culture.—There are two modes of cultivating kale—(1), by drilling in the seed where the crop is to grow, and (2), by raising plants in a seed-bed, and transplanting. The former practice requires from 4 to 6 lb. of seed per acre; for the latter purpose, 1 lb. is sufficient. A smaller quantity would answer for drilling, if every seed were certain to be in the right place, and the young plants had no enemies. The cost of seed is greater for the drill than for the seed-bed, but this difference is more than neutralised by the additional expenses which the transplanting system entails, to say nothing of the loss which is involved in seriously checking the growth of the plant. The saving of labour effected by the drill is alone a very considerable item, therefore, we unhesitatingly advise the practice of drilling. The seed should be drilled in rows 30 inches apart, and when the seedlings are well above ground, they should be thinned out to 30 inches apart in the rows.

Seed-bed.—Should the seed-bed be decided on, make the soil thoroughly rich and friable, so that when the young plants are drawn from it, the fibrous roots may be as little injured as possible. Sowing in rows is desirable, for the crop can then be kept clean, and is altogether more manageable than when the seed is sown broadcast. From the outset every plant must have space enough to make a stocky growth, or the seedlings will be leggy, and never afterwards develop into the splendid proportions attained by plants that have been short and stout from the commencement.

Transplanting.—A dull or showery day should be selected for transplanting. Allowing 30 inches apart each way, about 7,000 plants will be required per acre. It will help to give them a start, if the roots are dipped in a thick puddle, consisting of a mixture of soil and artificial manure, with only sufficient water to render the mixture adhesive. As a rule, the holes are

best made with a dibber, and care should be taken to put the plants in perfectly straight. If the roots are doubled up, ill-formed specimens will be produced, or the plants may fail altogether. The soil must be closely pressed round the neck of the plant as a finish to the operation. The ground should be kept free from weeds, either by hand-labour or the horse-hoe.

Feeding value.—Analyses show that the cabbage family contain nourishing constituents to the extent of 6 per cent. of carbohydrates, over 1 per cent. of albumen, and very little fat. The stalks are richer in these elements of plant food than the leaves; also, that young plants are more nutritious than old plants; the outer leaves are better food than the inner leaves or hearts; and, weight for weight, the open-leaved varieties (kales) are preferable to the hearting cabbages. It has been proved by experience that cows increase their milk wonderfully when fed with thousand-headed kale."

The following is an extract from Mr. Russell's paper:—"Thousand-headed kale is the least known and most desirable of any green crop I have ever seen. It is a plant that produces more feed per acre than any other, does not disagree with any stock, and does not impoverish the land. With me it has never caused sheep or lambs to blow or scour. Eighteen perches per day, with a little oat straw, have kept 270 sheep for three months, without the loss of one."

The engraving is taken from a figure by Vilmorin.

The Cultivation of Rape.

THE ADVANTAGE OF ALTERNATIVE CROPS.

BY J. L. THOMPSON,
Hawkesbury Agricultural College.

THE following brief paragraph under the above heading, appeared in the *Adelaide Observer* under date 5th December, 1885 :—" We have inspected a splendid crop of wheat on the Beefacres Estate, in · · · respect to which the farming community in South Australia ought to be especially interested. Two years ago the field of 150 acres was sown for wheat, but the yield was so poor that the crop was not worth reaping, this result being attributed to long cropping with cereals, which had made the land wheat-sick. Mr. J. L. Thompson, the manager, then determined to try the effect of a rape or colza crop, and this was sown at the rate of 6 lb. of seed to the acre, without manuring. The rape turned out well, and travellers by coach on Tee-tree Gully Road used to talk about the splendid crop that was to be seen on that journey. The rape served to feed many hundreds of sheep for some months, and then the land was deeply ploughed up, and, in due season, again sown with purple straw wheat at the rate of 45 lb. per acre, without any manure whatever. The crop is being reaped with three 'Hornsby's and one 'Walter and Woods'' string binders, and stands closely at about 5 feet high. There are close upon 2 tons of straw and probably 30 bushels of wheat per acre. This extraordinary result of rotation of crops without manure and with no extra cultivation except ploughing a little deeper than usual, and especially considering the dry season experienced at Beefacres, only 12 inches of rain having fallen during the growing season, ought to be instructive to all farmers in this colony."

The Growth and uses of Rape.

The growth and uses of rape are not known or appreciated by the average farmer in these colonies, but a few in South Australia, Victora, and New South Wales have grown it for many years with great success.

I saw in a Victorian paper not long ago, the editor of which has some pretentions to agricultural knowledge, this plant described as a new kind of grass, and as very valuable for feeding sheep, &c. Rape has no affinity to the grass family (Graminaceæ) ; it belongs to the Crucifers. Rape (Brassica campestris) is extensively grown in some parts of Europe for the oil expressed from its seeds, and to provide pasture that will fatten sheep readily. The rape plant is a native of Europe, perhaps of England, but it is hard to say where it is actually indigenous and where naturalised. It bears a close resemblance to swede turnip in the early stages of its growth, but

usually attains a greater height than the turnip, and produces more of stem and leaves. It has a fusiform and stringy root, while that of the turnip is bulbous. On average soils, when grown in drills, it usually reaches a height of from 18 to 20 inches, but on soils very rich in vegetable matter it sometimes attains a height of between 2 and 3 feet.

There are several varieties of rape, but the only kind I have had any experience with as a pasture is known as the dwarf Essex.

Like the turnip, rape is adapted to temperate climates. It will be found to grow in temperatures that are cool rather than warm. In New England and other cool regions of this Colony it will grow best during the summer months, but on the Hawkesbury, and in all warm regions it will grow best during the winter months. The most suitable soils for growing rape are fairly moist free-working loams, rich in organic matter. Black loams are also suitable, containing, as they generally do, a large amount of humus. Good maize, potato, or turnip land will grow rape. It will also grow on clay soils after the plants get a start, but not so luxuriantly as on the other soils I have mentioned. Rape as a rotation crop cannot, in my opinion, be excelled. As the extract at the commencement of this article shows, I had wonderful results with the plant in recuperating old worn-out wheat land in South Australia. At Dookie I had a similar experience. There, a paddock of 40 acres which in 1886 had been sown with wheat, was not worth cutting, so poor had the returns been reduced from continued cereal growing. In January of the year following I ploughed the land deeply, and exposed the soil to the ameliorating influence of the hot summer sun. Towards the end of March I had it thoroughly cultivated fully 6 inches deep with scarifier, disc harrow, ordinary harrows and roller, until it was brought to a tilth equal to the proverbial "onion bed." Early in April, and just after the first autumn rains, with sufficient moisture to ensure the rapid germination of the seed, I sowed the rape broad-cast, at the rate of 6 lb. to the acre on the finely-harrowed surface. To cover the seed, I simply passed the roller over it. This, I may say, is sufficient covering, the smaller seeds if buried too deeply do not germinate, and the seedsman is blamed unjustly. Nature sows her seeds very shallow, and they germinate and grow well, especially if they are not wanted to.

The plants appeared in less than a week, and the rough leaf in a fortnight. Owing to the moisture and warmth at that season of the year, it grew like magic, and by the end of May was fit for the ewes and lambs. Over twelve head per acre were pastured on this rape, besides numerous milch cows and other cattle, until January, 1888, when the residue, with all the sheep droppings, was ploughed under, but not too deeply. The land was allowed again to sweeten for a few months, and the vegetable matter to decompose. It was next sown with "Chevalier" barley, in the proportion of 1 bushel to the acre—this was towards the end of April. The yield was 25 bushels to the acre of a magnificent sample of malting barley, which was sold for seed at 6s. 6d. per bushel. This prosperous result was gained in a season when the rainfall for the whole year was only 14·51 inches.

In the following year this land was again sown with "Chevalier" barley, and produced a prime sample, which yielded 20 bushels to the acre. In 1890 I sowed this land with Cape barley, oats, a little rape, vetches, peas, and beans for an ensilage crop, and secured a yield of fully 10 tons to the acre of prime succulent herbage. This was cut in November, the land was manured with farm-yard compost, and immediately sown with sorghum, which yielded in the following February 15 tons, being 25 tons per acre of cow feed in a dry district.

But to return to rape. I have secured better results by sowing it in drills, and, when the ground requires cleaning, this is the best method of cultivation. When drilled in from $1\frac{1}{2}$ lb. to 2 lb. of seed to the acre will be sufficient, but when broad-casted, 5 lb. to 6 lb. will be necessary. The seed can usually be purchased at 3d. per lb., so that the cost of the seed is very small.

When sown in drills, as the rough leaf appears on the plant, the horse-hoe should be freely used between the rows to keep down the weeds, and to keep the soil open and loose, fracturing the capilliary tubes which bring the moisture from the lower strata, and is dissipated into vapors in the air. No attention need be given to the thinning of rape. Rape being an excellent cleansing crop when grown in drills and cultivated, it may, with advantage, be grown between two crops of grain.

Rape can also be grown as a catch crop, *i.e.*, as soon as a cereal crop is removed ,if the land is not too stiff, the stubble land may be simply scarified, harrowed, and brought to a fine tilth, and the seed sown. The crop may be either pastured or ploughed in as green manure.

Rape makes a capital soiling crop. The crop can be cut down and fed to cows or other animals in a shed, or scattered over a small paddock or yard. But it is as a farm manure that rape is of so much value to the Australian farmer in recuperating his worn-out wheat-sick soil.

The question may fairly be asked, how can the growing of rape without manure, and ploughing it in improve the fertility of the land, seeing that nothing is added to it, but that is only restored to it which was taken out by the crop? To this inquiry I reply, the benefits of a rape crop, so far as I can judge, are as follows:—

Science teaches us that a large proportion of the leaves and stalks of succulent herbage is composed of substances taken from the atmosphere, such as moisture, carbon, hydrogen, oxygen, &c. The roots of the rape plant permeate the soil, and draw to the surface from the subsoil valuable plant food. The rootlets improve the mechanical texture of the soil, and enrich it in their decay, and the whole plant when ploughed in decomposes, thus contributing considerably to the organic matter.

Rape contains about 8 per cent. of carbo-hydrates, 2 per cent. of albumen, and a little fat. It cannot be excelled for fattening old ewes, or producing fat lambs for the market. When very young and succulent rape is liable to scour sheep; to prevent this, a little hay or straw chaff should be within reach of the animals to counteract this tendency.

In New Zealand and Canada half a pint of oats per sheep is allowed, with very payable results. Rock salt, in all cases, should be within reach of the sheep.

Rape is not suitable as a food on which to feed milch cows exclusively, as it taints the milk. It is, however, capital food for pigs, and they are very fond of it.

Fertilizer for Rape.

Although rape will give a profitable return during an average season on fair land, thoroughly cultivated, without manure, it is responsive to an application of farm-yard manure. It is probable that the application of a complete fertilizer will give satisfactory results.

From experiments carried out with fertilizers applied to this plant, at the Ontario Agricultural College Experiment Station, Canada, the best results were obtained from the application of nitrate of soda, and the next from the application of salt.

Precautions to be observed in feeding with Rape.

Stock should never be turned into rape when hungry—otherwise they will eat too much of it and become blown, and probably a large percentage may die. When the man in charge of the sheep at "Beefacres" put 2,000 ewes into 150 acres of rape for the first time, he lost eleven head within two hours. He then took them out, and put them into a bare paddock; the sheep all lay down at the gate, wanting to get in again to the rape. When the gate was opened, they required no dog to drive them back to the rape; they rushed in at full force, and being empty with their long fast, commenced eating most ravenously, with the result that twenty-two died within an hour. The shepherd, terrified, took them all out, and came to me to report progress. I instructed him to then put the sheep in with a full stomach, and leave them there. He replied to the effect that if he did this I should lose the half of them. I assured him that I would take all responsibility. We had, at the time, a field of winter proud wheat, and next morning I went up and gave instructions to let the sheep into the wheat field, where they filled themselves thoroughly.

The rape paddock adjoined the wheat one, and the gate was opened, so they quietly passed from the wheat into the rape. Being so full of wheat, which, by the way, does not blow them like rape, they could not eat the rape so greedily, and, consequently, did not fill their stomachs with gases. We did not remove them again for two months, nor did we lose another sheep. It is the worst possible plan to put stock into succulent herbage, such as lucerne, rape, clover, &c., for a brief period, and then remove them to a bare paddock. The sheep, which has less brain for its size than the rest of our domestic animals, has, I incline to believe, some reasoning power, and no doubt reasons somewhat thusly:—"If I am allowed to remain only half an hour in this fine rape, I must make the most of my time." The consequence is rapid feeding, which speedily distends the rumen or paunch with gas, and if relief is not soon obtained, death ensues.

I have been very successful with cattle and sheep, when first put on to succulent herbage, by simply putting them on with full stomachs, and then leaving them there. Owners of pure bred pedigree stock should use great care when pasturing valuable animals on rape.

In my opinion there is great room for the extension of the rape industry in Australia. One acre will fatten ten lambs. I know of no other plant of the same importance so likely to assist to develop and fatten a cross-bred or long-woolled sheep suitable for the English market. In this respect rape is much superior to turnips, inasmuch as it will grow in many parts of New South Wales where turnips would fail.

Breeding Sheep for the Frozen Mutton Industry.

By A. BRUCE-SUTTOR,
Department of Agriculture.

The breeding of sheep is at present engaging the attention of flock-owners and others interested in producing a class of sheep that will combine both mutton and wool of superior qualities, and the subject gives ample scope for prosecuting experiments with the view to improving the different breeds by crossing. Since the development of the frozen meat industry the export of mutton has become a source of great profit, and in order to give further encouragement to the trade it is desirable to raise that product to the highest point of excellence. In these colonies the merino sheep largely predominate, and as it is an ascertained fact that that type of sheep, from its dissimilarity to the English breeds, is unsuitable for export purposes; it is deemed advisable to cross the merino with the long and intermediate woolled sheep, and to, if possible, breed a separate and distinct type of sheep which will answer all the requirements; but the production of that sheep appears to be as yet in perspective.

Most of the experiments hitherto conducted have been carried out in New Zealand, where provision has been made for supplying the important freezing industry with approved quality of mutton, and the breeders there have not been slow to utilise the special advantages afforded them by that colony, and it is quite to be expected that they will be foremost to arrive at the end in view, though, as Australia is equally interested, every effort should be made here to expedite the movement. The pioneers who introduced the merino have greatly benefitted by doing so, and the wool from these sheep has unquestionably been the mainstay of these colonies, and has always been, and is still, the chief staple of export, but now since it has been found so profitable to produce mutton of a better quality for freezing, the mutton becomes as important a factor as the wool, and lengthened experience has proved that though the merino gives such excellent results from wool their mutton lacks the good flavour of the British sheep, and it is found that by the infusion of the latter blood into the merino, the quality of the mutton is greatly improved. A question as yet pending is which of the long or intermediate woolled breeds are the most profitable for crossing with the merino for the purposes of the wool and mutton conjointly, and also for the establishment of a special breed, so greatly to be desired, that will meet with the general approval of breeders. Many crosses have been tried with varied degrees of success; the first cross invariably proving satisfactory, but after that cross, in most cases, one or other of the distinguishing characteristics of the sheep are sacrificed, and it is difficult to determine what is the next course to pursue to continue the improvement, and opinions vary widely on the subject. In dealing with the question of the wool the value of the cross must in a great measure depend on the prevailing fashion, though, generally, the cross-bred wool from the long-woolled varieties commands fully average prices. Crossing with some of the Down breeds greatly improves the mutton, though the wool becomes extremely light and unprofitable. A large percentage of lambs result, and they come early to market as fat lambs, but they do not as a rule wean so well, or come to maturity so early as the long-wools.

In taking the wool only into consideration the long-wool breeds are decidedly the best sheep to cross with, but with regard to the mutton, if this breed is persevered with, it usually partakes of the nature of the sire, and becomes coarse in texture, and too much of the consistence of tallow. This defect is more applicable to other of the long-woolled breeds than to the Lincolns, which, if given good fresh pasture, and proper attention, may be bred into more deeply with better results, and as wool producers they are far superior to all the other kinds.

An objection to the Lincoln, and also to some other of the long-woolled breeds, notably the Romney Marsh and Cotswold, is that they cannot so profitably be mated with the small merino ewe as could be desired, in consequence of their large heads and bone, causing great mortality amongst the ewes at lambing. In this respect the Leicester breeds have the advantage, by reason of their taper heads and fine bones, thus lessening casualities, and for first crossing they must, therefore, be given the premier position. They are remarkable for being very prolific, promoting maturity, improving the fattening propensity, and they give a fairly heavy fleece of wool of good staple.

Amongst the Downs the Hampshire has many good points to recommend it for crossing, though it is not of sufficient value to warrant a continuation of the cross, and exception may also be taken to its large head, and, again, the carcase is not so symmetrical as either the Southdown or the Shropshire-down. It has a magnificent back, well covered with lean meat, but in the underlines it falls away.

This article is not written with a view to discuss at length the relative merits of each of the British breeds which may be used for crossing, but to give a brief *résumé* of some of the most prominent with which experiments have been made, and appended is a table showing the respective points here allotted to each of the breeds, which must not, however, be taken as absolutely correct.

TABLE showing the relative points allotted to different classes of long and intermediate wool sheep for crossing with the merino.

	Maximum.	Lincolns.	English Leicester.	Border Leicester.	Romney Marsh.	Cotswold.	Southdown.	Shropshire-down.	Hampshire-down.
Form	100	80	70	90	65	80	100	90	65
Weight of carcase	80	67	68	62	68	80	55	68	68
Quality of mutton	90	75	72	70	65	55	90	77	85
Constitution	100	80	70	100	85	70	80	80	80
Propensity to fatten	50	47	50	45	42	50	45	45	50
Result of lambing	60	60	58	60	40	55	55	55	40
Early lambs	80	78	75	75	65	70	78	80	80
Early maturity	65	60	62	65	50	45	38	40	58
Weaning	45	40	42	45	43	40	22	20	25
Feeding	45	42	40	45	35	38	38	40	40
Soundness of foot	50	43	45	48	50	40	40	40	40
Weight of wool	75	75	50	60	50	50	25	37	43
Quality of wool	80	75	80	78	63	65	70	60	60
Adaptability to circumstances ...	80	65	60	80	70	65	68	65	75
Total	1,000	887	842	923	791	803	804	797	809

We may now consider which are the best breeds of sheep to blend for the purpose of establishing a separate type for freezing, taking the pure merino ewe as a base to work from. As the constituent parts of the long-woolled and the merino sheep are so very dissimilar, the first cross with these two breeds is evidently too severe, and a more gradual process is needed. It may, therefore, be suggested that the Southdown be first used. This latter sheep possesses all the attributes of a perfect mutton producer, is flesh from head to foot, has a low and symmetrical frame, with a small head and fine bone. The result of this cross will prove to be excellent mutton, but will probably lack size and wool, and it should be again crossed with the Border Leicester, the result of which should provide a heavier carcase and a better fleece, and, should the progeny of this latter cross not prove to be all that may be desired, the Lincoln may be recommended for a final, and third cross on account of its superiority as a wool and mutton producer.

Selected rams from the cross between the pure merino ewe and Lincoln or Leicester rams are sometimes used to mate with the half-bred ewes, and with fair results, but the progeny, through having a tendency to throw back, are not of a uniform character, and are often bare of wool at the points. The merino rams have also been tried to produce "comebacks" from the crossed long-woolled ewes, but the result has been found to be unprofitable.

Remarks on the sending and judging of Wine Samples in connection with the competition for National Prizes and cognate matters.

By P. F. ADAMS,.
Casula, Liverpool.

REFERRING to my report of 26th February, covering awards of prizes, &c., for wine exhibits at Agricultural Show, Inverell, I would desire to offer some further remarks. The sending of samples to be judged under the auspices of your Department is, I believe, a new departure, and one that deserves consideration. It appears to me to open another means of extending the usefulness of the Department, and I would advise that agricultural societies in localties where wine-growing is in its infancy should be encouraged to follow the example of Inverell.

I must, however, take exception to the system of confining exhibits to the produce of one variety of wine only. It is open to two objections. First, it will have a tendency to check any improvement that might be derived from judicious mixture of grapes at the vintage, or by subsequent blends of wines; and, secondly, it relegates too much to the taste of the judge, who, out of a mixed lot of wines, dry—sweet, light, and strong—has to decide which he considers to be the best. Judgment by points, as far as the principle can be applied to wines, will not help him.

As it happened, I had no difficulty in this case, as few samples came into actual competition at the last. Had they approached the even quality usually exhibited at the Metropolitan Show, I could not have undertaken the task with only one set of samples and in a limited time.

This question is by no means a new one. The objections to it led the Sydney Society to adopt their mode of classification, which I would recommend to all societies in New South Wales.

Returning to the subject of mixing grapes at vintage—blending wines, &c.—and assuming that the Inverell Society desires information, otherwise they would scarcely have sent their wines to Sydney for adjudication, I will offer an opinion on the wines examined, and the practice of the district, as far as I can judge, from the samples, which I suppose to be representative, although up to the present I have no knowledge of the localities, vineyards, and names of vignerons.

Samples for exhibition should be bottled in clear glass so that condition may be observed. It was necessary in three-fourths of the cases to empty the sample into a glass measure before its actual state of condition could be ascertained. Again, some of the red wines were so black with extract that

without a wine speculum (which I do not possess) their conditions could not be judged. The excess of iron in the soil and the great actinic power of the sun causes this excess of colour, which is associated with harshness and astringency, when unchecked by judicious handling at vintage. Astringency, harshness (tartar), and colour are indispensable in good wine, but in excess they prejudice the product. Astringency may be avoided by not allowing the fermentation to be continued too long in the skins, but if danger of checking fermentation in the process of removal is feared only a portion of the skins should be used.

As to harshness, I am not aware of any means of preventing the excess of tartaric acid in grape-juice, and very much doubt whether it would be advisable to make the attempt. In time it will combine with the natural potash of the wine, and be deposited in incrustation on the staves of the casks. Excess of colour will not be found in wines where the steps recommended to avoid astringency have been taken.

However, I look for a future for the Inverell wines rather to a demand that must sooner or later arise in the coast districts for wines suitable for export. It will be found that a blend of wine grown away from the sea influence will, with pale and thin wines of the coast, make a wine marketable in Europe to almost an unlimited extent. In other words, while the growers in the Hunter district are injuring their product by forcing colour out of pale skins, those at Inverell are suffering in the very opposite direction. The solution lies in a judicious blend.

If the practice of referring wines for judgment to the Department of Agriculture obtains, it will not only be the means of ascertaining what the products of districts may be, but it will afford an opportunity of blending the products of different districts and further assist in educating the taste for good wine, which is at present in a backward state in this Colony.

I am not prepared to assert it for a fact, but I suspect that some of the samples had been at some period in casks infected with moulds, to which they are liable if not kept always full to the bung when in use, and constantly under the influence of sulphur fumes when not. The cure for this is super-heated steam. An apparatus costing a few pounds only would, in a very short time, cure all the casks in the district and leave them as good as new.

If stalking and crushing machinery is not in use and its advantage not fully understood, I would recommend it in every vineyard of 5 acres and upwards, not only as a means of saving labour, but from the facilities afforded to dealing with stalks and skins in making delicate wines. The Inverell district appears to be well suited to the production of full-bodied wines, and probably they will form the bulk of its future produce, because light dry wines can be produced nearer the seaboard where colours, &c., are deficient.

I was, however, much interested in the exhibits of white shiraz, and regret that I had not a second set of samples, accompanied by some of the lighter growths of Madeira. I think a small addition of the latter in must, or at the earliest period at which they could be blended, would produce a very good wine.

The Reisling and Pineau wines show promise, and I regretted that the state of fermentation prevented my forming a decision on the young wines, especially those of the former variety. I was unable to determine whether they were made from the German or Sheppherd variety, although exhibit W1 appeared to have been made from the former variety; but I was unable to recommend it, as I found it too acid. One thousand grains volume (in terms of distilled water) required 14 grains of carbonate of soda to neutralise

the acid. It would have been interesting to ascertain how much of this was due to volatile and how much to fixed acid. If the former, it would lead to the belief that acetic acid (vinegar) had been allowed to form.

I am unable to understand why a great proportion of the white wines were made so sweet. I am under the impression that "liqueur wines" are not so saleable as those less saccharine. They are certainly more difficult to handle in the second and subsequent years, and are very liable to go wrong, even in the most experienced hands.

I have already referred to the high colour and astringency as quite unnecessary and superfluous, even for blending. No wine need be so dark that a mixture of equal parts with white wine or water will give a result any darker than a sample of good French claret.

I am unable to speak well of the class 183—so-called claret. These samples appeared to have been made from inferior fruit; I could trace no resemblance to claret or the presence of the Cabinet Sauvignon grape.

The samples of "port" exhibited were above the average of wines made in New South Wales under that designation, but I must doubt whether they had been made by adding the spirit first and crushing the grapes with the spirit, as done in Portugal. I have only known of two instances in which this was done, and the produce had a distinct flavour of "port."

I am informed that port wine is not left to ferment upon the skins and stalks, and that as soon as the requisite amount of colour has been produced the marc is pressed and treated almost the same as white wines, and to ensure colour enough in some cases a small proportion of "Tinto" grape is used, and if the result is not black enough for the English market an extract of elder-berry is used.

I gathered from the description I read that the port wines are not produced from a very rich must, and that only a sufficient quantity of spirit is added in the crushing-tubs to bring out the colour, otherwise the fermentation would be checked; the remainder of the spirit being added after full fermentation has been developed and the must considerably attenuated thereby.

It must not be supposed that I am advocating the addition of spirit to wines, but if the public must have strong drink I cannot blame the vignerons for supplying it; but such product should have a place as fortified wine.

In any case excess of sugar is dangerous in a wine, unless held in check by an undue proportion of spirit. It tends to generate fungoid growths, and moulds on the staves of the casks, and if not checked by heat, may so prejudice the cask, that any wine put into it would be for ever tainted.

In connection with the above report passing reference may be made, pending the publication of the full report, to some results of the tests made by Mr. Adams of samples of wine exhibited at this year's Inverell show, and which were forwarded to Sydney to be judged. It may be mentioned that Mr. Adams notes a marked improvement in the exhibits as compared with last year. The necessity urged by Mr. Adams of sending duplicate samples is again called attention to, the want of such having prevented steps being taken to judge in connection with a special prize for the "best wine." Then, again, Mr. Adams points out that information regarding the ages of the samples and the grapes from which they were made would enable the judge to report in advice which would not fail to be of much assistance to wine-makers. Another matter to which attention is called is the necessity for information regarding the quantity in stock and the price of samples submitted in competition.

National Prize Competition, 1892.

Mixed Farms.—North Table-land District.

T. C. WORBOYS, Judge.

In submitting detailed reports on the farms in the North Table-land, the district entrusted to me as Judge in connection with the competition for national prizes, I have the honor to present for your information a few general remarks suggested by the condition of the various properties inspected.

I started on my tour of inspection on the 14th November last, and visited the first farm at Dubbo on the following day. Thence I proceeded to Wellington, Tenterfield, Inverell, Guyra, Armidale, and Kelly's Plains, in the order named, visiting in all nineteen farms, three entered in Class I, and sixteen in Class II; of this number, four farms competed last year, the owners of two of them receiving money prizes.

I am pleased to be able to report that this year's competition is much keener, owing to the more general excellence of the farms entered. There are distinct signs that an increased interest is being taken by the farmers themselves. This is shown not only by the gratifying receptions accorded to me, but also by the fact that many suggestions made on the occasion of my previous visits, had been carried out, and with most satisfactory results.

One suggestion which has been acted upon with success was the turning of pigs upon wheat from the time it showed above ground, until it begins to spindle, which would be about the latter end of September. The farmer who followed this course was more than pleased with the result. He told me that he had between thirty and forty pigs most of the time on one field of about 12 acres up to the 1st October, and at the time of my inspection, I estimated the crop at from 35 to 40 bushels to the acre, while that portion of the crop where no pigs had been running would result in about 25 to 30 bushels. This practice has been followed on my farm for the last twenty years, and I have therefore no hesitation in recommending it, provided the pigs are kept off the ground when it is too wet. Most farmers I have visited keep a few pigs shut up all the year round just to eat up all the slops. There is a notion that pigs do not pay; neither will they kept in this way; but proper kind of pigs, such as improved Berkshires or Sussex, with good runs will pay as well as, if not better than, anything else on the farm. I am well aware that it will entail a small outlay to make the fences pig-proof, but when this is once accomplished, it will be a source of considerable satisfaction and profit to the farmer who tries it.

A proper system of book-keeping is another matter of considerable importance, the necessity for which cannot be too strongly impressed on our farmers. This is a case in which either sons or daughters can be of assistance. There is no other means of ascertaining whether the farm is a paying

or a losing concern, and therefore it is essential as a pure matter of business. The simplest system, according to my experience is to open an account for each paddock, and put down each night the work done. This will show when the crop is realised whether there is any, and what, profit for each paddock after deducting labour, wear and tear, and seed, and will also form a useful record as regards rotation. I find 4s. per day per man, and 1s. per day per horse is a fair average price to charge. This is calculating the men's wages at 20s. per week, and allows 4s. per week for providing such elements in his keep as are not produced on the farm. The 1s. per day per horse will just cover the wear and tear of implements and machinery. Accounts should also be opened for cattle, sheep, horses, pigs, poultry, and dairy respectively. It will be found that the additional trouble is amply repaid, and moreover is a means of education to the young people, which they cannot acquire in any other way. Several farmers who adopted this system of keeping accounts as suggested on my previous visit, have expressed themselves as highly pleased with the results. I may, perhaps, be permitted to add that the absence of properly kept books renders it impossible for a judge to properly estimate that most important point, the management of a farm with a view to profit.

It is pleasing to be able to report a marked improvement in some of the farmers' homes, since my last visit, and that still further improvement is intended before another year is out. Some of the new competitors did not appear to be fully aware of what was requisite to ensure success in these competitions, but now they are fully posted, they will be better prepared for next year.

The crops in the Tenterfield district are fairly heavy and moderately clean. At Inverell they are very heavy, and on most of the competing farms are fairly clean. Black oats, however, are a source of great trouble, and another very troublesome weed which is spreading in the Northern districts is that known as "Hexham scent" (*Melilotus parviflora*, Desf.) I am informed that if the seeds of it get amongst threshed wheat the millers refuse to purchase, as they spoil the flour. Another weed which is very troublesome I caught sight of on the road from Glen Innes to Inverell is the Darling-pea* (Indigo), (*Swainsona galegifolia*, R. Br.) What with weed pests, and the absence of railway communication, the Inverell farmers have no doubt a great deal to put up with. In my opinion, if ever a railway was required to any town it is to Inverell. The enormous area of splendid agricultural land included in the district, and its capabilities for growing not only cereals, but nearly all kinds of fruit, are quite sufficient to warrant the construction of a line.

Before coming to the awards there is another matter in connection with mixed farms to which I should like to make passing reference. The majority of farmers do not appear to be able to grasp the fact that, as far as they are concerned at least, the day of the Merino sheep has passed. What is wanted now is the cross-bred sheep, one possessing a big frame, and also giving a large clip of excellent wool. As far as I am concerned, the keeping of cross-breds is no theory with me, and I can recommend them from my own experience, as coming early to maturity and giving more wool.

It will be noticed that in several instances no points accompany the detailed reports of farms. This has arisen in consequence of my inability to obtain the necessary information with reference to general management with a view to profit. Mr. W. Leech, of Tenterfield, was unfortunately away from home at the time of my visit, but he wrote to me stating he could not

* For figure and Analysis of Darling Pea see Vol. IV, Part 2, pp. 84, 85.

supply the information required in time for this year, but would see that everything was in order next year. Mr. Sutton, of Guyra, asked me not to report upon his place, as he had not got certain improvements completed, as he expected he would have, but hoped to have them ready for another year. Mr. Franklin Jackes, of Armidale, as fully explained in my detailed report, has not been sufficiently long on his farm to enable him to give information regarding management with a view to profit, and while I should have been very pleased to have recommended some award as an encouragement to him to continue the excellent work he has begun, the conditions of the competition will only enable me to congratulate him, and express the hope that he will enter the next competition.

The awards which I have the honor to recommend to the Minister's favourable consideration are as follows :—

Class I.—Up to 200 acres. (Two prizes offered.)

First prize.—Not awarded.
Second prize.—Thos. Curley, Tenterfield.

Class II—Over 200 acres. (Four prizes offered.)

First prize.—Charles Hampden Barton, Wellington.
Second prize.—James Culbert, Nullamana, Inverell.
Third prize.—Henry Donnelly, Bryan's Gap, Tenterfield.
Fourth prize.—Samuel Littler, Inverell.

Class I.

Mr. Thomas Curley, Tenterfield.—Recommended for Second Prize.

I inspected this beautiful property, which is situated just outside the town of Tenterfield, on the 24th November last. It consists of 175 acres, of which about 110 acres are cleared. Of the cleared portion, 22 acres are under wheat, which looked well and was fairly clean; 22 acres oats and wheat mixed, intended for hay—rather a light crop; 21 acres of lucerne ready for cutting, but rather light. About 30 acres are planted as an orchard, comprising a splendid assortment of fruits, which, in a few years, will be a source of great profit. Most of the trees looked healthy, but a few have been very badly attacked by the woolly aphis, and others have died right out for want of underground draining. The orchard is not as clean as it ought to be.

The stock consists of 6 draught and 13 light horses of fair quality and in fair condition; 23 head of cattle of fair dairy sorts, about 37 pigs of poor breed and in poor condition, and a few poultry.

The machinery, which is in fair order, consists of a reaper and binder, 2 mowing machines, hay rake, hay press, 2 drays, 1 two-furrow and 1 single-furrow plough, 1 potato digger, 1 set of harrows, and 1 roller.

The buildings consist of a splendid house and gardens, which being let to a private person, cannot be included in the competition; a barn, machine shed and granary, all built of wood and in fair order, two men's huts, cow yards, and pig yards.

No draining has been done. There is no system of conserving manures, although all that is made is utilised; nor is there much system of rotation of crops. Water is plentiful, but there are no appliances for conserving it. The system of laying down grasses and lucerne is only fair, but the mode of book-keeping is very good.

The following is a statement of the year's (1892) income and outlay:—

Receipts.	£	s.	d.
Wheat	108	0	0
Hay	77	0	0
Chaff	32	0	0
Potatoes	11	5	0
Cherries	28	0	0
Apricots	9	0	0
Apples	10	15	0
Pears	2	11	0
Nectarines	1	4	0
Plums	8	14	0
Preserved fruits	12	0	0
Vegetables	4	18	6
Milk	23	9	6
Eggs	3	16	0
Poultry	4	8	9
Pigs	43	15	0
Cattle	14	5	0
	395	1	9
	168	12	0
	£226	9	9

Expenditure.	£	s.	d.
Wages	120	0	0
Stripping wheat	30	0	0
Removing fence	2	15	0
Cutting chaff	4	10	0
Pruning	8	7	0
Sundries	3	0	0
	£168	12	0

Mr. Franklin Jackes, Iranistan, Armidale.

I paid my visit of inspection to this farm on 9th December last. The property is situated about 1½ miles from Armidale, on the Glen Innes road, and consists of about 116 acres. The land is fairly good, some portions being apparently very rich, and well suited for growing almost all kinds of cereals and fruits. There is no doubt as to this being a mixed farm, only everything is on a very small scale. Considering the short time Mr. Jackes has had the property he has certainly done well. His aim is to possess a model farm, and by next year he intends to have things in good order. The homestead is situated on an elevation, commanding a view of nearly, if not quite, all the property. The dwelling-house, which is of very neat appearance, contains eleven rooms, including kitchen, &c., under the one roof, and is built of sawn timber. There is also a dairy, store-room, wash-house, workshop containing a splendid assortment of most useful tools, buggy house and men's room, forge with all necessary fittings, &c., cart-shed, cow-yard and shed, pig-sties and run, sheep pens, a small stable and barn combined. The accommodation for poultry includes excellent houses and yards, and an incubator room, all well arranged. This is a branch to which Mr. Jackes intends devoting considerable attention, and his stock already includes some silver-laced Wyandottes, Plymouth rocks, Cuckoos, Black-red Colonial Game, brown and white Leghorns, Minorcas, Langshans, and Buff Cochins, with cross-breds for table purposes. He has also some Rouen and Pekin ducks, and some Toulouse and Embden White geese. Mr. Jackes has also a small conservatory, in which he raises horticultural specialties. He has planted round the fences walnut and oak-trees, which will in a few years add very much to the beauty of the place, as well as being a source of profit. The fences and gates are fairly good, and there is only one slip-rail on the place, which it is intended to replace with a gate as soon as possible. Around the garden and orchard is a white-thorn hedge, which, when cut back and filled, will present a very good appearance. The orchard is about 2 acres in extent, and contains about 250 healthy young trees. About 1½ acre is laid out as a garden, which was sown with almost every kind of vegetable, but heavy

rains coming on soon after the seeds were sown, most of them were destroyed.

There are about 50 acres of the farm cleared, of which 4 acres are under white Tuscan wheat, kept very clean; 5 acres of potato-oats, clean; 9 acres of corn, just up and looking well; 2 acres of potatoes, and a small patch of lucerne. It will be seen that the farming operations are carried on on a small scale at present, but there is a good piece of land ready for ploughing next year.

The stock on the farm are of good sorts, and in good condition, and comprise 2 draught and 1 light harness horses, 8 dairy and 4 young cattle, 15 sheep, and 4 pigs, all looking well. The implements consist of 1 double and 1 single, and one small orchard plough, 1 set harrows, 1 roller, scarifier, corn-sheller, Planet-junr. hoe, seed drill, and an oyster-shell mill for grinding shells for the fowls, 1 dray, and 1 buggy. So far, no regular system of cropping has been attempted, owing to the short time Mr. Jackes has been in possession. The conservation of water is good, and consists of a large dam, with tanks for supplying the homestead. For the reason already given, the only means of conserving fodder is in the form of hay. No underground draining has been done, nor has the conservation of manures yet received attention, and no information is available regarding returns.

Under these circumstances I have been unable to award points, so that Mr. Jackes is debarred from receiving a prize, which I should otherwise have been very pleased to recommend. I can only congratulate him on the success attending his efforts, and advise him to enter his farm in next year's competition.

Mr. George M'Lane, Inverell.

I inspected this property on the 26th November last. It comprises 159 acres of rich blackish-red soil, a sort of mixture of clay and loam, which is very heavy to work, requiring six or eight horses to work a two-furrow plough. The property is situated at Little Valley, about 7½ miles from Inverell, on the banks of the Macintyre River. About 100 acres has been cleared, of which 20 acres are under wheat, a very heavy crop, but not very clean; 20 acres oats, good crop, but not clean; lucerne, about 40 acres, being cut for hay, very dirty, with black oats, &c.; corn, 10 acres, fairly clean; garden, 2 acres, dirty; also about 3 acres of orchard, very much neglected.

The stock, which are in fair condition and of fairly good sorts, consist of 14 draught and 10 saddle and light horses, 15 head of dairy cattle, and 19 stores, 3 pigs, and 30 fowls and ducks.

The machinery and implements consist of a reaper and binder, 2 mowing-machines, horse hay-rake, horse-power chaff-cutter, winnowing machine, horse-power corn-sheller, generally in fair order; 1 three-furrow, 1 two-furrow, and 6 single-furrow ploughs, 3 sets of harrows, 1 roller, 1 scarifier, 1 corn dropper, 2 drays, spring-cart, and buggy, all in very good order.

The buildings include wooden farm-house, containing four rooms, fairly comfortable; detached kitchen, built of slabs, not very well finished; fair dairy and store-room; grain store built of wood, in good order; machine shed, very good hay shed, harness-room, cow-yard and shed in fair order; 3 pig-sties.

There is a plentiful natural supply of water for stock purposes, and the homestead is supplied by means of tanks, but there are no appliances. There is no system of manuring, it being asserted that none is required. The system of conserving winter fodder is very fair. There is no system of laying down grasses other than lucerne. There are no gates; the fences are

in very bad repair, and the general appearance of the place is very poor. No books are kept, so that I was not able to obtain a statement of receipts and expenditure, consequently had the farm appeared to deserve it, the inability to allot points would prevent any award being recommended. While, I have no doubt, Mr. M'Lane makes his farm pay, I cannot help suggesting that a little more attention should be paid both to appearance and general comfort, particularly as regards gates, which are badly wanted in all the main thoroughfares.

Class II.—Over 200 acres.

Mr. C. H. Barton, Mary Vale, Wellington.—Recommended for First Prize.

I visited this farm on the 16th November last, when Mr. Barton was kind enough to drive me over the whole of it. The property covers about 5,000 acres of really splendid land, situated about 2 miles from the Mary Vale railway station, and about 7 miles from Wellington. About 1,500 acres have been cleared, about 1,300 acres of which are under wheat. Of this crop, 900 acres will be left for wheat, and operations had just commenced to cut the remaining 400 acres for hay, as it was slightly dirty. The crop was a splendid one, and I quite believe the 400 acres for hay will average 3½ tons to the acre, while the 900 acres, which was very clean and presented a splendid appearance, will probably produce 27 to 30 bushels per acre. There is also 100 acres of lucerne, most of it looking very well; about 20 acres of corn and pumpkins looking fairly well, but not quite so clean as might be. The very heavy and continuous rains in October and the beginning of November, prevented them from getting on the land with the horse-hoe, and even at the time of my visit, although the weather had cleared, the machines could hardly travel to cut the hay. There are about 100 acres in fallow, in good order, getting ready for next season, and a large amount of timber has been grubbed, and the land is in course of preparation. The intention is to clear 200 to 300 acres yearly. The soil for the most part is a rich grey loam, with clay subsoil, inclined to stick very much in places which makes it heavy to work. No draining has been done, nor is much required, as most of the land has good natural drainage; just a few low-lying places would be all the better for it. Considering the short time Mr. Barton has had this farm, wonders have been worked. The entire management is in the hands of his foreman, Mr. R. Smith, a smart, pushing man, deserving of great praise for the rapid and thorough manner in which the work is performed.

The homestead consists of a farmhouse containing four rooms, kitchen &c., at back detached, large store-room, men's huts, blacksmith and wheelwright's shop, with all necessary tools, large grain store, with wide skillion on the side for drays, waggons, &c., large woolshed and stable combined, the former fitted with steam shearing appliances complete. There is a small machine-shed not at all in keeping with the machinery to be protected, but it is intended to replace this next year with a shed capable of holding the whole of it. There are also two large haysheds some distance from the homestead, also several working men's cottages for married couples in different parts of the farm. One great hindrance to the more successful management of the farm is that two or three selectors have portions within it. The property is well watered, and the water is well applied for stock purposes.

The machinery is first-class, most of it being nearly new and comprising nearly everything required on a farm of this magnitude. It consists of 5

reapers and binders, steam threshing plant complete, steam chuff-cutting plant, steam hay and straw press and wool press, 5 Hornsby three-furrow and 3 single-furrow ploughs, 2 strippers, 4 sets of harrows, 2 disc harrows, and other small implements.

The stock consists of 8,000 cross-bred sheep, 70 horses, 50 cattle, 30 pigs, and a quantity of poultry. No regular system of dairying is carried on, but the married couples are allowed to use what milk and make what butter they require for their own use. No system of conserving manure is at present considered necessary. The fencing is nearly new, and together with the gates is in fairly good order. The book-keeping is the best I ever saw on a farm, and the following is a statement of receipts and expenditure for the year 1892:—

Expenditure.	£	s.	d.	Receipts.	£	s.	d.
Wages	1,062	18	7	Wheat	2,107	9	7
Horses...	179	0	0	Hay and chaff	577	3	0
Implements	645	0	0	Lucerne seed...	102	9	0
Sheep	1,137	0	0	Hay	33	16	6
Wear and tear	100	0	0	Straw	230	8	0
General expenses	230	0	0	Sheep	635	14	6
				Pigs	25	0	0
	£3,353	18	7	Wool	1,200	0	0
					£4,912	0	7
					3,353	18	7
					£1,558	2	0

Mr. James Culbert, Nullamana, Inverell.—Recommended for second prize.

My visit of inspection to this farm was paid on 28th November last, when Mr. Culbert met me at Inverell, and drove me out to Nullamana. The farm is situated about 9 miles from Inverell, on the Emmaville Road, and covers about 725 acres of very rich red volcanic soil, having an easterly slope. The homestead is beautifully situated, and comprises a neat four-roomed house, built of sawn timber with an iron roof, a nice detached kitchen and store-room. Round the house is a well-kept flower-garden, together with a nice vegetable-garden, vinery, and orchard, partly enclosed with an ossage orange hedge, which looks very beautiful. Most of the out-buildings are in keeping, and include a well-built granary and hay-shed; machine and cart-sheds fairly good. There is a very poor five-stall stable, and I was pleased to hear that it was condemned, and that a new stable was to be erected as soon as possible. This homestead will then be one of the prettiest and most complete little homes I have met with.

The stock, which is in splendid condition, and of good quality, consists of 7 draught and 4 light horses, 5 dairy and 11 store cattle, 1 Hereford bull, 4 pigs, 850 sheep (not quite up to the average), and a very good lot of poultry.

The machinery, which is all very good, and well cared for, comprises a stripper and winnower, mowing-machine, horse-rake, corn-sheller, and chaff-cutter. The implements, which are also in fair condition and well taken care of, include 2 double furrow and 2 single furrow-ploughs, 1 set of iron harrows, 1 scarifier, 1 roller.

Mr. Culbert has about 135 acres cleared, 80 of which are under wheat; the most of it being very clean and promising a very heavy crop. The black oat has got amongst about 20 acres of it to a slight extent, and 20 acres have been cut for hay. Twelve acres planted with corn look well cultivated and fairly clean, and there are 8 acres of potatoes, some of which are ready for digging, and look remarkably clean and healthy. This is one of the best

spots I have seen for potato-growing in the northern district, and Mr. Culbert informed me that his crop averages 6 to 8 tons per acre, with an occasional increase. The land is very rich and easily worked.

The water supply is plentiful, and is conserved by means of dams, the homestead being supplied with tanks but without appliances. The only means of conserving winter fodder is by turning it into hay. The system of rotation of cropping is very fair wheat being followed by corn and then potatoes. The only drainage necessary is a few open drains for carrying off surface-water. There is a very fair system adopted for conserving and applying manure; the fences and gates are well put up and present a neat appearance, and there is no system of laying down grasses. The mode of book-keeping is fair, and the following is a statement of receipts and expenditure for the year 1892:—

RECEIPTS.

	£	s.	d.
Wheat	283	18	0
Potatoes	47	7	0
Corn	48	13	0
Sheep	30	0	0
Wool...	58	6	3
Cattle	5	0	0
Pigs	9	10	0
Butter and eggs	6	10	2
	489	4	5
	125	10	0
	£363	14	5

EXPENDITURE.

	£	s.	d.
Wages	60	0	0
Shearing	6	0	0
Harvest	15	0	0
General labour	15	0	0
Horse labour	21	0	0
Rock-salt	8	10	0
	£125	10	0

Mr. Henry Donnelly, Bryan's Gap, Tenterfield.—Recommended for Third Prize.

I PAID my visit of inspection to this farm on November 23rd last, and found that Mr. Donnelly and his good wife had got everything in apple-pie order. It is situated on the old Grafton Road about 7 miles from Tenterfield. The soil is a rich red sandy loam, with granite subsoil. The farm is 248 acres in extent, of which 60 acres are nicely cleared. Twenty-four acres are under wheat, all looking well and clean, excepting about an acre just round a shed which is rather "oaty," and is to be cut for hay. I estimate this wheat will thrash out 25 to 27 bushels to the acre. There are about 24 acres under corn, looking splendid, with scarcely a weed to be seen. The oat crop was also looking well and clean, and the potatoes were just being planted in a piece of ground which was in splendid order. The garden and orchard, covering about 2 acres, showed signs of continual care and attention.

Mr. Donnelly keeps an entire, and breeds his own horses. The entire is not of the best description, but is a good, useful farm horse. The stock includes about thirteen draught horses and four light harness and saddle horses, this being more than enough to work his farm, besides a number of young stock growing up for market. There are about seventy head of mixed cattle including about twenty-five milkers. The pigs are of a splendid breed —improved Berkshire—the best I saw in the district, and well housed and cared for. The poultry house and yard are well laid out and in good order.

The machinery and implements, which are all in fair order, and ample for all requirements, consist of a reaper and binder, stripper and winnower, horse-power chaff-cutter and corn-sheller, 1 double and 2 single-furrow ploughs, 2 sets iron harrows, 2 horse-hoes, waggon, dray, and buggy.

The buildings consist of a farm house, containing four rooms and a passage, very neat and clean, built of wood, with brick chimneys; detached

kitchen with two rooms, built of wood, and containing a brick oven; a large barn well built of wood; machine shed; poor dairy; well-arranged store-room; small dray shed; potatoe house; a stable and cow-yard. A cow-shed is badly wanted, and a little more attention should be paid to housing the dairy cattle in winter, and obtaining as much manure as possible. All the manure is carefully collected and used, but so far no system has been adopted. The water supply is good, and appliances very fair, the homestead being supplied by means of tanks.

Mr. Donnelly is just beginning to turn his attention to the important subject of drainage. Very little underground drainage is required, but large open drains are necessary to carry off the water which rushes down from the higher ground, in order to save the soil from being washed away. No means are used of conserving fodder for winter except as hay. The fences and gates are only in fair order, and one or two old log fences want burning out and replacing with something neater. The system of book-keeping is very good, and the following statement of receipts and expenditure for 1892 will show the good results of a small area well attended to:—

Receipts.	£	s.	d.	Expenditure.	£	s.	d.
Wheat	81	0	0	Wages	75	0	0
Corn	97	16	3	Horse labour	30	0	0
Chaff	27	5	0	Machinery	10	0	0
Pumpkins	30	0	0	General expenses	15	0	0
Turnips	4	0	0				
Potatoes	2	8	0				
Butter and eggs	48	16	9				
Sundries	11	0	2				
	£302	5	2		£130	0	0
	130	0	0				
	£172	5	2				

S. W. Samuel Littler, Inverell.—Recommended for Fourth Prize.

I inspected this property, which is situated about 14 miles from Inverell, and 3 miles from the main Glen Innes Road, on the 25th November last. The farm covers about 481 acres of splendid, rich black-red soil, very sticky and requiring a great deal of horse-power to work it. There is good natural drainage, and the land generally has a northerly aspect. The homestead stands on a nice little rise and is very well laid out, the out-buildings being well and neatly built. The gates and fences are in splendid order, and show great taste and good workmanship. A few further improvements, as, for instance, a separate machine shed in case of fire, would be beneficial, and I understand Mr. Littler intends putting this in hand.

Mr. Littler does not farm very extensively, but what he does is well done. He has about 40 acres of wheat, a most splendid crop, very nearly all clean, and estimated to yield from 30 to 35 bushels to the acre; about 20 acres of corn which was put in rather late and was only just coming up at the time of my visit. The land, however, looked thoroughly well worked. There were 10 acres of lucerne, and a small paddock was nicely laid down with lucerne for the calves. The potatoes were a complete failure having rotted in the ground owing to the continued wet weather. There are also a garden, an orchard, and a vinery, which form a source of revenue, although the orchard is not kept quite as clean as it ought to be.

The stock is in splendid order, and of sorts well suited to farm and dairy purposes. There are 8 draught and 3 light horses, 6 dairy cattle, about 300 Merino sheep, 4 pigs, and about 30 head of poultry.

The machinery and implements are in fair order and comprise a stripper, reaper and mower, horse-rake, horse-power chaff cutter, horse-power corn-sheller and corn-cracker, machine knife sharpener, 1 double and 3 single-furrow ploughs, 2 scarifiers, 1 set iron harrows, 1 roller, wool-box for filling bales, winnowing machine, Avery's weighing machine.

The buildings consist of farm house, containing seven rooms with two bed-rooms detached, all built of wood, and of very neat and clean appearance. A short distance from the house stands a nicely built room in which school is conducted by a young lady. There is also a detached wash-house, workshop with forge, large barn and shearing-shed combined, well arranged, and with wool-store attached; hay-shed and chaff-store combined, 7-stall stable, sheep drafting yards, cow-yard, but no milking-shed which is badly wanted. A run is also required in connection with the pigsties to enable the pigs to have a certain amount of freedom. This is a matter of greater importance than is apparently appreciated by the generality of farmers.

There is a plentiful, natural supply of water for stock purposes, and the homestead is supplied by means of tanks, but there are no appliances. There is no system of making and conserving manure, little being at present required. No underground draining has been done, nor is it required, but a quantity of surface draining which is needful has been constructed. The system of rotation is corn, then wheat, then lucerne, and hay is the only means adopted for conserving fodder for winter. No books are kept, but I managed to obtain the following statement of receipts and expenditure from bills, receipts, &c, which were submitted to me.

Receipts.	£	s.	d.	Expenditure.	£	s.	d.
Wheat	107	10	0	Wages	90	0	0
Corn...	100	0	0	Wear and tear	30	0	0
Chaff	4	0	0	General expenses	10	0	0
Bacon	11	0	0				
Sheep	12	0	0				
Garden produce	50	0	0				
Wool	60	0	0				
	£344	10	0		£130	0	0
	130	0	0				
	£214	10	0				

Mr. Peter Bowes Eddy, Eddy Park, Inverell.

This property I inspected on December 2nd, and it is so extensive that it took me part of two days to inspect it. There are two divisions about 2 miles apart. The nearest part, on which the homestead is built, is situated about 8 miles from Inverell, on the Warialdà Road, called Eddy Park, containing about 1,925 acres of very rich red chocolate soil, rather thickly timbered. The homestead is situated at a very beautiful spot near the centre of the property. The buildings consist of the farm house, a very neat well-built house of seven rooms constructed of sawn tongued and grooved timber with a verandah all around; a kitchen and bed-room detached; 2 men's huts, three rooms each; a neat little house of four rooms, a little distance away; 3 granaries; with machine shed underneath, fairly well built; 1 stable; 1 workshop with forge; and all necessary tools; and 1 buggy house, &c.

Mr. Eddy cultivates a large quantity of land, about 500 acres have been cleared, 370 acres are under wheat, about 184 acres of which are clean, the remainder being rather dirty with oats; some patches are to be cut for hay; one paddock of 57 acres will yield about 40 bushels to the acre, and it is

estimated the average yield will be between 25 and 30 bushels per acre. The principal wheat grown here is the White velvet, which appears to be quite free from rust; there is about 30 acres of hay and 27 acres of lucerne; of perennial rye and cocksfoot grasses there are about 13 acres.

The orchard has an area of about 2 acres planted with a variety of fruit trees looking very healthy; there is a splendid crop of potatoes growing amongst these trees.

The other portion of the property is called Black Gully, and contains about 1,357 acres with a rich red soil capable of growing almost anything; the two properties are carried on under the one management, and are looked upon as one farm.

Mr. Eddy has a fair lot of horses and cattle which include about thirty working bullocks, sixteen draught horses and thirteen light horses, ten dairy and eight young cattle, in fair condition only, and three pigs, not much attention is paid to these, as I have found in most places.

The machinery and implements include the following:—2 three-furrow ploughs, 3 two-furrow ploughs, and 2 single-furrow ploughs, 1 large cultivator, 3 sets iron harrows, 2 rollers, 3 strippers, 1 winnower, 1 horse-power chaff-cutter and corn sheller, 1 mowing machine, 1 horse hay-rake, 2 waggons, 2 drays, spring cart, 3 buggies and sociables.

There are 2,500 sheep kept, but there is no shearing shed and wool store as economy is used by driving the sheep near to the railway to have them shorn. A quantity of poultry is kept; all the milk, butter, and eggs produced are consumed on the premises.

There is no system of rotation of crops except maize and wheat. I may say here that Mr. Eddy has adopted a very good plan for getting rid of his produce, viz.: All the wheat produced he has ground into flour. He then despatches this with the bran and pollard, by his own teams, to sell away in the back country.

The conservation of water on this property is very good; for stock purposes the supply is by dams and wells, and the homestead is supplied by means of underground tanks. There are no appliances used except a pump. The salt troughs for the sheep are well arranged.

The means used for conserving fodder are poor; there is no underground drainage as it is not much required; there is no system of making or conserving manures, but what is made is used in the garden and orchard; the fences and gates are only in fair order, and things generally have not that neat tidy appearance which they might have with a little good management and taste. With a small outlay this could be made a very nice place. Mr. Eddy intends to have some good ideas shortly carried out. The system of book-keeping is good as the following will show.

RECEIPTS.

	£	s.	d.
Flour	1,549	16	2
Bran and pollard... ...	188	11	3
Wheat	33	9	10
Wool	347	14	7
Machinery...	55	0	0
Horses	57	0	0
	£2,231	11	10

EXPENDITURE.

	£	s.	d.
Wages	300	10	0
Blacksmiths account ...	21	0	0
Grinding	162	15	6
Carriage of flour... ...	13	4	6
Cattle	51	10	0
Lucerne, seed, and grasses	21	15	5
Sundries	25	0	0
Chaff and corn	33	8	0
Hay	7	0	0
	£636	3	5
By Balance	£1,595	8	5

Messrs. Faint Bros., Spring Valley, Kelly's Plains.

I inspected this farm on the 9th December instant. The property consists of about 750 acres of mixed soils, the flats and low-lying portions being of a rich black clay, very heavy to work, and the higher portions of a dark-red soil with a mixture of gravel, heavily timbered. It is situated about three quarters of a mile from Kelly's Plains Platform, and about 5 miles from Armidale, and was fully described in connection with last year's competition when a Second Prize was awarded.

The crops this year consist of about 70 acres of wheat, 52 acres of which is a very light crop but very clean, and the rest a heavier crop but very dirty; 10 acres has been cut for hay; corn, about 3 acres, very poor, having been partly destroyed by the heavy rains; a small plot of barley, looking well. The potato crops have been destroyed as well as on most other farms in the district through execessive rains coming just after they were planted. There are about 45 acres of sown grasses, which look fairly well, and about 75 acres of orchard containing fruit trees in large variety, which, in a few years, will be a source of considerable profit if properly attended to. At present they are very much neglected, and a smaller orchard with proper attention would be more profitable.

The stock are of fairly good sorts and in splendid condition. They consist of 14 draught and 10 light and young horses, and 1 entire "Lofty" of the Clydesdale breed, rather small; 7 dairy and 12 store cattle, and 1 cross-bred Durham bull, 4 pigs, and about 50 head of fairly bred poultry.

The remaining items are practically the same as last year, and the following is a statement of receipts and expenditure for 1892:—

Receipts.	£	s.	d.	Expenditure.	£	s.	d.
Wheat	257	10	10	Wages	96	16	0
Fruit	26	2	6	General expenses	33	1	0
Horses	64	0	0	Bags	8	12	4
Cattle	80	5	0				
Butter and eggs	4	4	2				
Straw	32	1	0				
Fruit trees	11	17	6				
Bacon	2	18	0				
Potatoes	0	4	0				
	£479	3	0		£138	9	4
	138	9	4				
	£340	13	8				

Messrs. J. & D. Fraser, Rose Valley, Inverell.

I inspected this farm, for which a Highly Commended Certificate was awarded in connection with last year's competition, on the 29th November last, and found the Messrs. Fraser busy with their harvest. The farm having been already described, and the description published in the *Gazette*, it will only be necessary for me to report on the condition of the crops and stock for this year.

There are 220 acres nicely cleared, and the crops consist of 150 acres of wheat, of which 100 acres are clean, and the remaining 50 slightly dirty with black oats. I estimate this crop will yield 30 bushels to the acre all round. The wheats chiefly grown are Steinwedl and White Tuscan, and I believe the latter will turn out the better crop. Twenty-five acres of oats have been cut for hay; there are about 30 acres of corn planted, rather late; about 5 acres of potatoes, and 3 of pumpkins, rather dirty; about 8 acres of lucerne only fairly good.

As regards stock there are 12 draught and 11 light and young horses, not in quite such good condition as they might be; 10 dairy cows and 20 steers; 890 sheep and lambs, looking very well. There have been considerable losses amongst the sheep and lambs, the latter especially, from eating Darling Pea or Indigo (*Swainsona galegifolia*, R. Br.), which is becoming a great pest in the district. Horses also occasionally take to eating it, generally with fatal effects. There are also 12 pigs and about 100 head of poultry.

Since the former report was made, a system of rotation in cropping has been adopted, consisting of corn, wheat, potatoes, and lucerne. In other respects the farm is practically in the same condition as last year. The following is a statement of the receipts and expenditure for the year 1892:—

Receipts.	£	s.	d.	Expenditure.	£	s.	d.
Wheat	498	13	4	Wages	120	0	0
Chaff	3	0	0	Threshing	22	10	0
Potatoes	2	10	0	Shearing	4	0	0
Wool	76	16	6	Bags and bales	22	10	0
Butter and eggs	9	11	0	Horses	16	0	0
Pigs	8	2	0	Blacksmith's account ...	33	10	0
				Saddler's account	8	10	0
				Sundries	5	0	0
	598	12	10		£232	0	0
	232	0	0				
	£366	12	10				

Mr. John Moore, Rob Roy, Inverell.

This property, which I inspected on the 25th November last, is situated about 10 miles from Inverell, on the Reedy Creek Road. It comprises about 1,000 acres, 400 acres of which are situated about 1 mile further on, consisting mostly of rich, red, or chocolate, volcanic soil, suitable for growing almost all kinds of cereals and fruits. About 3 acres of vines are planted, of sorts best suited to drying for raisins, a few currant vines, 2 acres of English fruits, and a quantity of orange trees, all looking fairly well, although not kept quite as clean as they should be. There is not much cultivation on the outlying portion. A few acres—about 8—are well fenced in with wire fence and netting. This portion is kept partly for experimental purposes, and the depredations of kangaroo-rats have rendered the wire-netting necessary.

The 600 acres where the homestead is situated consist of a rich black soil, very heavy to work. The homestead is beautifully situated about the centre of the property commanding a view of all the cultivated portions. There are about 200 acres of wheat, 60 acres of which is very heavy and clean, 80 acres fairly clean, and 60 acres dirty. The crop is estimated to average 25 bushels to the acre. The wheats principally grown on this farm are Purple Straw, White Lammas, and Defiance. There are 8 acres of oats, a fair crop, but not quite clean; 60 acres of corn, coming up well, and fairly clean. The average corn crop here is about 40 bushels. About 26 acres are laid down with lucerne, and there is a small flower and vegetable garden.

The stock includes 18 draught, 4 saddle, and 7 young horses, of good, useful, farm sorts; 20 dairy, and 20 young and store cattle; 900 sheep and 350 lambs, looking well. Shearing was proceeding at the time of my visit, and I noticed that considerable attention is paid to the sheep, which are being well worked up. There are also 5 pigs, to which little attention is given, and a quantity of fowls and geese.

The machinery and implements include nearly everything required to work the farm, although a few improved appliances would be advantageous. They comprise a reaper and binder, stripper and winnower, steam threshing machine, steam-power chaff-cutter, steam corn-husker and thresher, corn dropper, mowing machine, seed sower, 1 three-furrow, 3 double-furrow, and 3 single-furrow ploughs, 2 sets iron harrows, cornstalk chopper, roller, scarifier, sulphur blower and spraying machine, waggon, 2 drays, spring-cart, and buggy.

The buildings consist of farm-house, containing four rooms, detached kitchen, with four rooms, all built of sawn timber, fairly comfortable; store-room; men's hut, built of wood, not very good; workshop, with forge, very dilapidated; granary; cornshed and shearing-room combined, fairly good; harness-room, cart and buggy house, very poor; small machine-shed, not at all adequate to the machinery; two haysheds; chaff-house; stock-yard, very badly placed; horse-yard, but no stable, which is badly wanted. The fences around the sheds are very poor indeed, and things generally about the place have a rather slovenly appearance. With a few alterations and improvements, a very pretty homestead could be made. The fences and gates generally are in fair order, but there is room for improvement. I was pleased to hear from Mr. Moore that he could see these improvements were required, and intended carrying them out. There is no system of drainage—not much is required; no system of conserving manures, although all made is utilised in the orchard and garden. The system of cropping is to alternate corn and wheat. The means used for conserving fodder are very fair. No system of laying down grasses other than lucerne. The water supply is plentiful, and the appliances a windmill and pump. The mode of book-keeping is very fair, and the following is a statement of receipts and expenditure for the year 1892:—

Receipts.	£	s.	d.	Expenditure.	£	s.	d.
Wheat...	283	15	0	Wages...	180	0	0
Corn ...	330	0	0	Harvest	26	0	0
Chaff ...	30	0	0	Shearing	12	0	0
Sheep ...	174	17	0	Spraying machine	7	0	0
Cattle ...	84	0	0	Bags ...	12	16	6
Wool ...	105	0	0	Sundries	30	0	0
Pigs ...	9	0	0				
	£1,016	12	0		£267	16	6
	267	16	6				
	£748	16	6				

Mr. John Simmons, Barley Hill, Armidale.

I visited this farm on the 8th December last, Mr. Simmons meeting me at Armidale and driving me to the property, which is nicely situated, about 2½ miles from the town, on the Mihi Road. It contains about 320 acres of very good land, the flats being a rich black soil, and the higher portions a dark-red loam mixed with clay, making it very heavy to work. About 200 acres have been cleared. Seventy acres are under wheat, 25 of which are being cut for hay; there are 11 acres of oats for seed, and 22 acres for hay. The wheat crops on this farm are somewhat lighter than in many places I have visited, and will, according to my estimate, average about 20 bushels to the acre; they are fairly clean. There are about 12 acres of corn, nice and clean, but not looking very well, the late heavy rains having washed away a large quantity of the soil right out of the field. This apparently has checked the

growth of the corn, and many farmers have had to make a second planting. There are also about an acre of potatoes, and about 1½ acres of orchard and garden, which would look all the better for a little more attention. Fruit appears to grow particularly well in this district, especially cherries, which are magnificent.

The homestead is prettily situated, about the centre of the property, and, with a small outlay, and a little good taste, can be made one of the nicest little homes in the district. Mr. Simmons is an old English farmer, and conducts his operations in good style. He is looked upon as one of the best farmers in the district, and although he does not obtain sufficient points to become a prize-winner this year, a little care and attention to details will make this farm hard to excel another year. The farm-house is built of wood, and contains six rooms; kitchen detached, with four rooms; the other buildings comprise barn, hay shed, stable, waggon shed, work-shop with forge, men's house, cart-shed and buggy house, fowl house. A separate shed for the machines is badly wanted; it is short-sighted policy to stow away expensive machines in hay sheds, where there is more than usual risk of fire.

The machinery and implements, which are well taken care of, consist of reaper and binder, mowing machine, horse-power chaff-cutter, horse hay-rake, weighing machine, one double and two single-fullow ploughs, two sets of harrows, roller, cultivator, horse-hoe.

The system of rotation of crops is fair, being wheat, followed by wheat or oats for hay, and then corn. Water is plentiful, but the only appliances are tanks for the use of the homestead. No underground drainage has been done, nor is much required; but a few low-lying places would be all the better for it. The system of manuring and of conserving the manure made on the farm, is very fair, but there is still room for improvement, and I am sure any labour and trouble in this direction will be amply repaid.

Some really good horses and cattle are kept, there being, of the former, 9 draught, 3 light, and 6 young ones. I have only seen one better lot of horses amongst all the competing farms. There are 8 dairy cows, 26 store and young cattle, and a splendid Hereford bull. The pigs are good, and are kept very clean, and there is a quantity of poultry. The system of book-keeping is very poor, being just sufficient to enable the preparation of the following statement of receipts and expenditure:—

Receipts.	£	s.	d.	Expenditure.	£	s.	d.
Wheat	60	0	0	Wages	180	0	0
Hay	235	0	0	Twine	3	15	0
Potatoes	4	0	0	Sundries account	20	0	0
Horses	15	0	0				
Butter	12	0	0				
Fruit......	5	0	0				
Cattle	7	0	0				
	£338	0	0		£203	15	0
	203	15	0				
	£134	5	0				

Joseph Monteith, Red Bank Farm, Guyra.

I inspected this property on the 6th December. It is situated about 2½ miles from the Guyra Railway Station, and consists of about 590 acres. The soil is of a red chocolate colour mixed with clay. A part of this property is rather heavily timbered, principally with gum, which is very difficult to get

rid of as it does not burn well, thus making the cost of clearing very expensive. The soil and climate are well adapted for potato culture as well as wheat, which is becoming one of the leading products of the district. Mr. Monteith has about 100 acres under cultivation, about 34 acres of which are under wheat, 15 acres under oats, and 37 acres under potatoes, the rest is fallow. About 17 acres of the wheat is looking very well and clean, the other portion is very poor and dirty; the oats are clean and looking fairly well; the potatoes are just being planted, and the ground is in good order. There is a small orchard of about 1 acre in extent, planted with young trees, which are badly attended to, but look very healthy. The horses are of a fair quality, but rather low in condition; the cattle are fairly good, but of a mixed breed; the pigs are fairly good, and a pig paddock is wanted badly. Mr. Monteith does not keep much machinery as most of his harvest work is done by neighbours under contract. The implements are all that are needed to work the farm, and are in good order. The few buildings (which are built of wood) are in fair order, comprise farm house containing four rooms, one hay-shed, potato-house, and a stable which is partly built. The rotation of cropping is fair, wheat is followed by potatoes; the water supply is plentiful, but there are no appliances other than a pump; the conservation of fodder is fairly good as all the wheat, chaff, and cavings are reserved for winter feed for the cattle and horses.

There seems to be no system of conserving manures, but what is made is carefully collected and used: some of the land in the Guyra district is fairly rich, yet I consider the soil will take all the manure that the farmers can make.

The book-keeping is very poor, but I managed to understand the following in reference to expenditure and receipts:—

Receipts.	£	s.	d.	Expenditure.	£	s.	d.
Wheat	165	12	6	Wages	58	0	0
Potatoes	215	0	0	Horse labour	60	0	0
Bacon	20	0	0	Corn	6	0	0
				Bags	20	0	0
				Sundries	30	0	0
	£400	12	6		£174	0	0
				Balance	£226	12	6

Mr. John Cameron, Ponds, Armidale.

This farm is situated about 6 miles from Armidale, on the Bundarra Road, and contains about 620 acres, a portion of which has a rich black soil, but, being rather low, requires draining; the other portion being high and dry, has a rich volcanic soil.

Mr. Cameron does not go into agriculture very extensively, his principal products being wool and sheep; he has cleared about 129 acres, of which 22 acres is under wheat, about 9 acres of this is very clean and good, the rest is rather dirty; the average yield is estimated about 25 bushels, about 8 acres is being cut for hay; there are also about 3 acres under potatoes, 2 acres of rye, and 1 acre of skinless barley; of sown grasses there are about 29 acres, looking fairly well.

There are 7 draught and 3 light horses, 5 dairy and 10 store cattle, and about 928 sheep, which are a fair average lot, but are suffering from foot-rot slightly, showing that the low lying lands require draining; there are only 2 pigs kept at present, but a large number of poultry.

The machinery kept on this property is of fair quality and in fair condition, consisting of 1 reaper and binder, 1 mowing machine, 1 horse hay-rake, 1 horse-power chaff-cutter and winnower; the implements consist of 3 single ploughs, 1 scarifier, 1 horse hoe, 1 seed drill, 1 set harrows, and 1 roller.

The buildings consist of the farm house with ten rooms, a detached kitchen and rooms, 3 hay sheds, 1 stable, 1 machine shed, workshop with forge, all in fairly good order; shearing shed, and granary combined.

As regards the orchard, which has an area of 5 acres, there is a great variety of fruit trees, some are looking well, others are affected with the blight, the orchard generally is very much neglected; there is no system of cropping rotation. The water supply is plentiful, by means of springs, for all stock purposes, and the homestead is supplied by means of tanks.

The means used for conserving fodder are fairly good; there is no underground drainage, which is wanted badly; several open drains have been dug; some of the fences are very poor, and want replacing, others are fairly good; most of the gates are in fair order; the system of laying down grasses is not very good, although a few acres, which Mr. Cameron has sown, are looking well; the mode of book-keeping is fairly good; the results of the year's labour is only fair, as the following result will show:—

Receipts.	£	s.	d.	Expenditure.	£	s.	d.
Wheat	71	15	2	Wages	120	0	0
Fruit	23	16	6	Extra labour	9	0	0
Potatoes	5	2	6	Bales	1	4	0
Hay	23	10	0	Blacksmith account ...	2	15	0
Sheep and wool	180	5	9	Machinery	6	2	6
Butter	2	1	9	General expenses	12	0	0
Fowls and eggs	10	7	7				
Horse...	9	0	0				
	£325	19	3		£151	1	6
				By balance	£174	17	9

Mr. John Miller, Bryan's Gap, Tenterfield.

On the 22nd November I inspected this farm; the property is situated on the old Queensland Road, about 4 miles from Tenterfield, and has an area of 220 acres of rich sandy loam, with a westerly slope. The homestead is situated on a nice elevated dry spot, from which a splendid view is obtained. This place has a very neat appearance, and as Mr. Miller has only just removed from a position on lower ground, the improvements are not yet what they are intended to be. The house contains four rooms, built of wood, and is in fair order, as also are the other buildings, which consist of kitchen and dairy and oven detached, a splendid barn, cart-shed, store-room, and workshop (with a small quantity of tools).

The machinery for working the farm is very poor, and consists of 1 mowing machine, 1 horse-power chaff-cutter, 1 corn-sheller, 1 single and 1 ridging plough, 2 sets harness, 1 roller, 1 cultivator, 1 horse hoe, 2 drays, and 1 buggy.

There is a splendid orchard of 10 acres, mostly young trees, looking healthy and well trained, except that they have run up a little too high before forming the head. In almost every other orchard in this district the same thing occurs. This may be a matter of opinion, but in most other districts where I have been the trees are kept much lower, and I think it is far better. The fruit-trees in this orchard are chiefly apple. Mr. Miller is looking

forward to his orchard, when in full bearing, being his chief source of revenue. He has been very unfortunate the last three years through being crippled with an affection of the legs.

Mr. Miller has also under cultivation 16 acres of wheat, 6 acres of oats, 10 acres of corn, 3 acres of potatoes and pumpkins. The wheat and oats are looking well and fairly clean. The corn is not looking well, and not so clean as it ought to be. The horses are in good order, and of a fair class. The cattle are in good order, and a good all round sort, both for the dairy and for beef. The piggery arrangements are very poor, and not at all clean. A pig paddock is badly wanted.

There is a good natural supply of water on the property in all seasons, and suitable for all stock purposes. The homestead is supplied by means of tanks.

There is no system of conserving manures, but what little is made is well taken care of. There is no system of conserving fodder other than hay and no system of drainage. The fences and gates are in fair order. There is no system of laying down grasses, and no book-keeping, but the following is what Mr. Miller stated as his expenditure and receipts :—

RECEIPTS.	£	s.	d.	EXPENDITURE.	£	s.	d.
Corn	79	0	0	Wages	60	0	0
Potatoes	33	5	0	Machinery	4	10	0
Pumpkins	4	0	0	Horse, labour, &c.	9	12	0
Fruit-trees	4	2	6	Sundry expenses	2	10	0
Butter and eggs	38	15	6				
Horse...	2	0	0				
	£161	3	0		£76	12	0
				By balance	£84	11	0

Mr. Clause Lohse, Tenterfield.

I was met by Mr. Lohse at Tenterfield on the 23rd November, and was then driven by him out to inspect his farm, which consists of 320 acres conditional purchase, situate about 5 miles from Tenterfield on the Wallengarra Road.

The soil is a grey loam, with a mixture of clay and granite subsoil. A portion of this property, near the creek, has a very rich soil, but the further the land is from the creek the poorer it seems to get. This is the poorest piece of land that I have inspected in the neighbourhood of Tenterfield.

Mr. Lohse, like many of the Tenterfield farmers, has only a small portion cultivated. There are 21 acres under wheat, looking well and fairly clean; 6 acres under corn, but rather poor and dirty; 10 acres under oats, not clean, and only fit for hay; 2 acres under potatoes, and an orchard of 3 acres, planted with 220 trees, which need more attention.

As regards horses, there are 6 draught and 6 light, which seem very suitable for ploughing purposes, though somewhat light. Of cattle there are 20 dairy, and 10 store, which are in fair order, and suitable for dairying purposes. There are also a few pigs, and a small number of poultry. There is a fair quantity of machinery in good order, consisting of 1 reaper and binder, horse-power chaff-cutter, reaper and mower, hay rake, 2 single-furrow ploughs, 2 sets harrows, 1 scarifier, 1 scales, 1 seed-sower, and 1 cornsheller.

The buildings consist of a farm-house with five rooms, built of wood, kitchen and store-room (detached), 2 barns, stable and machine-shed, built of wood, corn-yards and shed, and 2 pigstyes.

Water is plentiful, and the appliances for its distribution are very fair. There is no underground draining, although required, the few open drains not being sufficient.

There is one dray and a splendid buggy kept. Though no books are kept, Mr. Lohse seemed to remember all his transactions, and the result was as follows:—

RECEIPTS.	£	s.	d.	EXPENDITURE.	£	s.	d.
Wheat	90	0	0	Wages	65	0	0
Corn	8	0	0	Horse labour...	12	0	0
Hay and chaff	40	0	0	Other expenses	5	0	0
Pigs	3	0	0				
Butter and eggs	60	0	0				
	£201	0	0		£82	0	0
				By balance	£119	0	0

Mr. Wm. Leech, Rose Villa Farm, Tenterfield.

I inspected this farm on the 21st November last. It is situated about 3 miles from Tenterfield on the Boonoo Boonoo Road, and about 11 miles from the Queensland border. The property covers about 440 acres of grey sandy loam with clay subsoil, and there are a number of grey granite boulders about the farm, which are very prevalent in the district. The soil and climate of Tenterfield seem well adapted to the growth of all kinds of English fruits. Mr. Leech has not gone in very extensively for cultivation, but he grows a little of most things, wheat being the principal product. Of this cereal he has about 32 acres, most of it looking fairly well and moderately clean, while a few acres of it were very clean. The wheats principally grown in this district are Velvet-top and Talavera. There are also a few acres of oats, 12 acres of corn, 3 of potatoes and pumpkins, and about 16 acres fallow, all of which could be very much improved. The orchard, which is about $1\frac{3}{4}$ acres in extent, is planted with a variety of fruits, but the trees are too young to be a source of much revenue at present.

The homestead and its surroundings are neatly arranged, commanding a view of Tenterfield, and comprise a comfortable farm-house, built of wood, and containing six rooms, detached kitchen, dairy and store-room, splendid barn, hay-shed, cart-shed, milking yards and shed, workshop and forge, with an assortment of tools altogether beyond the ordinary supply.

As to the stock, the horses are in good condition, but rather light; the cattle are in good condition, and are good dairy sorts. The arrangement of the piggery is not at all good, a pig paddock being badly required.

The machinery and implements are in good order, and of a useful character. They consist of steam threshing plant, horse-power chaff-cutter, winnowing machine, corn-sheller and cracker, turnip drill, seed sower, disc harrow, ordinary harrows, roller, reaper and binder, side delivery reaper and mower, 1 double and 3 single furrow ploughs, cultivator, horse-hoe, ridging plough, dray, waggon, buggy, &c.

The fences and gates are all in very fair order. Water is plentiful, but not well applied, excepting for household purposes. There is no system of conserving manures, but all that is made is carefully collected and utilised. No draining has been done, although some is required, and hay is the only means adopted of conserving fodder. There is no system of laying down grasses. The system of book-keeping is poor, and in the absence of Mr. Leech I was unable to obtain any statement of receipts and expenditure.

Writing to me subsequently, Mr. Leech stated that he was unable to supply the required information for this year, and therefore I have been unable to allot any points to this farm in the absence of the most important item. This is another instance of the unsatisfactory condition in which a farmer places himself by omitting to keep a careful record of his receipts and payments.

Mr. James Holmes, Holmwood, Dubbo.

I paid my visit of inspection to this farm on November 15th. The property can hardly be judged under the head of mixed farms, as it is essentially a stud farm. There are no crops grown for market, the whole of the produce being utilized for feeding the stock of cattle, horses, &c. It is a beautiful property, comprising about 941 acres, and is situated about 2 miles from Dubbo on the old Wellington Road.

The homestead is well laid out, and comprises a house containing eight rooms, with kitchen and school-room detached, coach-house, stables, and men's room just a nice distance from the house, dairy and store-room, three good hay-sheds, and well-arranged yards. There are also well-arranged gardens, and an orchard with a choice lot of vines.

The stock consists mainly of pure-bred shorthorns, to which Mr. Holmes pays great attention. As well as being a hobby they are a source of considerable profit, and Mr. Holmes is a constant prize taker both at metropolitan and provincial shows. He is also very liberal in his dealings with the surrounding farmers, as he will give a well-bred young bull in exchange for an ordinary steer, his motive being to raise the standard of cattle in the Dubbo district, and in this I must say he has been very successful.

There are about 150 acres of cleared land, but only sufficient is grown to feed the stock. About 90 acres of lucerne have been laid down as well as other grasses, amongst them being a splendid paddock of rib grass, the best I have seen.

The water supply, however, is a matter which shows the result of the most careful consideration, even where everything is well considered. From a well over which a wind-mill is erected pipes are laid to all the yards; in fact, wherever water is required. Each yard is supplied with water troughs of iron, fitted with ball taps, so that troughs are kept supplied automatically.

The property is all well fenced, and there are gates wherever necessary. The uncleared portion is all ringbarked, a large proportion of the dead wood has been cleared up and the scrub taken up, causing considerable improvement in appearance, as well as in the quality of the grass.

The machines and implements required are few, but those which are necessary have been obtained, and are in fair order and condition. There is no system of conserving manure, but what is made is collected and utilized. Hay is the only form adopted for conserving fodder; no underground drainage has been constructed, nor is much required. The system of laying down grasses is good. The system of book-keeping is not very good, but sufficient to show the following receipts and expenditure for 1892:—

	£	s.	d.
Received for cattle, &c.	658	16	0
Expended for wages, &c.	180	0	0
	478	16	0

I should be pleased if the Minister could see his way clear to award Mr. Holmes a special certificate in recognition of the benefit he has conferred on the Dubbo district.

STATEMENT of Points obtained by the various Competitors.

	Maximum number of points.	Class I. Thos. Curley, Tenterfield.	Class II. C. H. Barton, Maryvale, Wellington.	Jas. Culbert, Nullamana, Inverell.	Hy. Donnelly, Bryan's Gap, Tenterfield.	Samuel Littler, Inverell.	P. B. Eddy, Eddy Park, Inverell.	Faint Bros., Spring Valley, Kelly's Plains.
		2nd prize.	1st prize.	2nd prize.	3rd prize.	4th prize.		
General management, with a view to profit	125	120	100	98	95	105	100	95
State of crops as to cleannes and cultivation	100	50	80	95	95	90	65	75
System of cultivation, rotation, &c.	80	40	40	60	50	40	50	35
Number and condition of subsidiary aids to farm ...	80	50	50	50	50	60	40	50
Conservation of water and its economic application..	80	40	70	40	50	40	60	60
Means used for conserving fodder	60	30	40	30	30	30	30	30
Kinds of implements used, condition, &c.	60	30	60	40	40	40	50	40
Productiveness of crops	50	25	50	40	40	40	40	30
System of underground drainage	50	......	..	...	..	...	...	...
System of manuring	50	15	...	25	25	20	20	25
Conservation of manure made on the farm	50	20	30	25	25	25	20	25
Class and condition of stock	50	35	40	40	30	45	40	40
Character and condition of fences and gates	40	30	30	35	30	35	30	35
Plan, character, and condition of farm-house, buildings, &c.	40	20	30	35	30	30	35	35
System of laying down grasses	20	15	15	...	...	15	10	15
Mode of book-keeping	20	15	15	15	18	...	15	15
Any new point of interest and commercial value, such as new crops, ensilage, &c.	20	......	...	...	...	...	...	...
Vegetable and fruit garden	25	20	75	20	20	80	15	15
Total	1,000	555	665	648	623	625	620	620

	Class II. J. and D. Fraser, Rose Valley, Inverell.	Jno. Moore, Rob Roy, Inverell.	John Simmons, Barley Hill, Armidale.	Jos. Monteith, Rea Bank Farm, Guyra.	Jno. Cameron, Ponds, Armidale.	Jno. Miller, Bryan's Gap, Tenterfield.	C. Lohse, Tenterfield.
General management, with a view to profit	25	95	100	95	75	50	60
State of crops as to cleannes and cultivation	75	75	75	80	70	60	50
System of cultivation, rotation, &c.	60	55	40	40	30	40	40
Number and condition of subsidiary aids to farm ...	50	50	50	30	50	40	40
Conservation of water and its economic application..	50	60	40	40	53	50	50
Means used for conserving fodder	30	30	30	40	30	40	30
Kinds of implements used, condition, &c.	50	35	40	50	40	30	30
Productiveness of crops	40	35	30	30	30	40	40
System of underground drainage	...	...	...	...	..	...	...
System of manuring	25	25	25	25	25	25	25
Conservation of manure made on the farm	25	25	25	25	25	30	25
Class and condition of stock	30	40	40	40	40	35	30
Character and condition of fences and gates	30	30	30	25	30	30	25
Plan, character, and condition of farm-house, buildings, &c.	25	30	30	25	25	30	25
System of laying down grasses	10	10	...	15	15	15	...
Mode of book-keeping	15	12	...	5	10	...	...
Any new point of interest and commercial value, such as new crops, ensilage, &c.	..	...	...	...	...	...	...
Vegetable and fruit garden	10	10	20	10	15	20	20
Total	620	617	575	575	580	535	490

N.B.—In a few instances the farms entered in this district were not pointed, owing to the want of information.

Mixed Farms—North Coast District.

G. CRISPIN, Judge.

Having the honor of being appointed by the Minister for Mines and Agriculture to be judge of mixed farms in the North Coast District, I respectfully beg to submit my estimates of the excellence of the various farms entered for competition.

It affords me very great pleasure to commend the able management, among other unsuccessful competitors, of Messrs. G. Morrison, D. M'Lennan, and John Stitt. The first named is, more correctly speaking, a sugar-cane farmer, and the other two being rather large holdings, have, therefore, failed to carry points under several of the headings which appear in the Schedule. I would recommend that three classes appear in future Schedules, viz.:—Under 100 acres, under 200 acres, and over 200 acres; for, under present headings it is almost impossible for large holders to compete against a small mixed farm.

One of the competitors, Mr. Rossiter, of Kempsey, Macleay River, although he occupies the land under tenancy, has raised the farm under his able management, to such a high order of merit that, in fairness to him and his farm, I feel justified in recommending the Minister for Mines and Agriculture to award a special prize equal to second prize.

Recommendations.

Class I.—*Any size up to* 200 *acres.*

Divide 1st and 2nd prizes, £25 each. Joseph Wass Johnson, "Lowlands," Upper Southgate, Clarence River; Hugh M'Lachlan, "Laurel Bank," Grafton, Clarence River.

*Special prize, equal to 2nd prize—E. Rossiter, "Leamington," Kempsey, Macleay River.

*3rd prize.—Shem Bartlett, "Fairleigh," Rous, Wardell, Richmond River.

Highly commended.—George Morrison, Chatsworth Island, Clarence River; D. M'Lennan, "Purfleet," Taree, Manning River.

Commended.—John Stitt, Taree, Manning River.

Class II.—*Over* 200 *acres.*

1st prize.—William O'Meara, "Maryvale," Hickey's Creek, Macleay River.

2nd prize.—Not awarded.

Class I.—Under 200 acres.

†Joseph Wass Johnson, "Lowlands," Southgate, Clarence River.—Recommended to divide with Mr. Hugh M'Lachlan, "Laurel Bank," Clarence River, the 1st and 2nd prizes.

This farm is situated between Frank's and Southgate Creeks, about 10 miles from Grafton, and contains about 53 acres. It is held on a tenancy by Mr. J. W. Johnson, at a rental of £80 per annum.

Cultivation.—Maize, 25 acres; sugar-cane, 7 acres; potatoes, 4 acres; oats and barley, 2 acres; lucerne, 1 acre; Hungarian millet, ½ acre; pease, ½ acre; the remainder being grass-land.

Cattle.—Dairy cows, 3; young stock, 5; steers, 2; bull, 1.

Horses.—Draught-horses, 4; saddle and buggy, 2.

Pigs.—Breeding sows, 2; stores, 10; boar, 1.

*Note.—Mr. Rossiter was awarded by the Minister 3rd Prize, and Mr. Bartlett a highly-commended certificate.

†Note.—This farm was fully described in connection with the previous year's competition.

Poultry.—A large quantity.

Buildings.—A very neat and compact homestead; store-house; bath and harness room; barn; chaff-house, hay-shed; workshop; implement-shed, stable for 4 horses; 3 bales; cow-stable; duck-house; 8 pig-styes; and buggy-house.

Implements.—1 double-furrow gang plough; 2 single-furrow ploughs; 1 potato-plough and corn-planter; 1 scarifier; 1 horse-hoe; 1 cultivator; 3 sets harrows; 1 chisel-toothed harrow; 1 roller; 1 wheel-barrow; 1 grinding-stone; 1 chaffcutter; 1 cornsheller; 1 corncracker; 1 fire-wood saw-bench; 1 horse-power; 1 weighing-machine (Fairbank's); 1 sack truck; 1 dray.

The canes grown on this farm are sold to a small mill-owner, who pays 14s. per ton for them. The maize, potatoes, and pigs are sent to the Sydney market. Oats, lucerne, and Hungarian millet are chiefly grown for farm-stock. The butter, eggs, and poultry are exchanged to hawkers who deal in all sorts of commodities. The management on this farm is good; the cultivation of the crops is very fair. Some of the maize was not as clean as I should have liked to have seen it, but Mr. Johnson informed me that the weather was very showery when it was fit to hill. His system of rotation is good. After a crop of maize oats and barley are planted, and maize after potatoes. About 4 acres on this farm is fallow, for autumn potatoes. The conservation of water on this farm is good, there being a never-failing supply, by means of a well and tanks. The means of conserving fodder is very fair, the fodder stack having a very neat appearance, and being well thatched. The implements are very complete and taken great care of. Green manuring is at times resorted to for the purpose of enriching the soil. The manure-heap on this farm is added to by the refuse from the piggeries and stables. The stock are good,—a very fine stamp of animals, and well cared for.

The homestead and out-buildings are in good repair and much better than will be seen on a free selector's farm.

The fences and gates are in good repair.

The books are only fairly kept.

A very small orchard and garden is very neatly kept, there being several varieties of fruit-trees and vines, flowers and vegetables.

Most of the labour is performed by Mr. Johnson, with the exception of harvesting his crops and stripping cane.

Although the farm is not a large one Mr. Johnson must realize a good round sum during the year.

Mr. Johnson deserves great credit for the manner in which he manages and conducts his farm.

Hugh M'Lachlan, "Laurel Bank," Grafton, Clarence River, recommended to divide 1st and 2nd prizes with Mr. J. W. Johnson, "Lowlands," Upper Southgate.

This farm is situated on a bank of the Clarence River, 6 miles from Grafton, and comprises 57 acres freehold, the soil being a deep and rich alluvium, with 29 acres of splendid grass land adjoining the cultivation, the best I have seen anywhere, and securely fenced.

Cultivation.—Maize, 14 acres; potatoes, 3 acres; lucerne, ½ acre; sugar-cane, 9 acres; also ½ acre for plants next season; water-melons, ½ acre; orchard, 1 acre.

Cattle.—Dairy cows, 9; young stock, 33.

Horses.—Draught, 4; light and buggy, 4; brood mares, 3; young draught, 4.

Poultry.—150 fowls.

Implements.—1 double-furrow plough; 2 two-horse ploughs; 2 hilling ploughs; 2 double iron harrows; 1 horse hoe; 1 cultivator; 2 scarifiers;

1 horse-power maize threshing machine, cleaner and bagger, the best I have seen; horse-power chaff-cutter and corn-cracker; grinding stone; wheelbarrow; sack truck; 1 cornstalk cutter; 1 roller; 1 dray; 1 buggy; 1 sulky, and blacksmith's tools.

Buildings.—The homestead is of brick, neat in appearance, and kept in a good state of repair; outbuildings, barns, workshops, and tool house, buggy-house, stock-yard, and milking bails.

The canes grown on this farm are sold to the Colonial Sugar Refining Company. About half has been cut this season, of which Mr. M'Lachlan had no account at the time of my inspection. The maize and potatoes are sent to the Sydney market. The butter, eggs, and poultry are exchanged to hawkers, who deal in all sorts of commodities. The general management on this farm is very good. The farm is well cultivated, most of the crops being free from weeds, especially from Paddy's lucerne and blue-tops, which are such pests on some farms. The system of rotation is to plant maize, which is looking well, after potatoes. It is Mr. M'Lachlan's intention to plough out about 4 acres of cane cut this season, and plant with autumn potatoes, and then replant with cane again; and he also has a small plot of cane planted for cuttings next season, which is a very good system to follow. Mr. M'Lachlan mostly ploughs his ground three times, about 7 inches deep, and also well cultivates it afterwards, and he also informed me that that has been his system for years. Water conservation.—A large underground tank supplies ample water for house purposes. There is also a well sunk in the yard, with pump and trough to water the horses, and also a never-failing supply in the cattle paddock. The implements are kept in good repair, and are all that are necessary on the farm. Green manuring is at times resorted to for the purpose of enriching the land. The stock on the farm are in splendid condition, some of the best I have seen anywhere. Mr. M'Lachlan took 1st prize for draught horse at last exhibition. The fences and gates are in good repair, and it is intended to substitute gates for slip-rails. The homestead is of brick, and it is a superior class of house to those usually seen on a farm. The out-buildings are all in good repair. Like many others. Mr. M'Lachlan's books are not very well kept. The orchard and garden are not in very good order on account of fowls. Mr. M'Lachlan has also got an air-tight barrel for keeping seed maize free from weevil, which is not often seen on a farm. He has also constructed a wall with 100 tons of stone to secure his bank in flood time, which is beneficial. The farm is worked chiefly by himself and his son, with the exception of stripping cane, and it is cultivated almost like a garden. Although the place is not a large one, the several productions must realise a good round sum per annum, under the able management of and care taken by Mr. M'Lachlan.

*Edward Rossiter, "Leamington," Kempsey, Macleay River, recommended a special prize of £20, equal to 2nd Prize.

This farm is situated within half a mile of the township of Kempsey, and is a highly fertile farm of about 120 acres, and is leased to Mr. Rossiter at a rental of £220 per annum. It has a frontage to the Macleay River.

Cultivation.—Maize, 85 acres; lucerne, 3 acres; oats for hay, 5 acres; potatoes, 4 acres; orchard, 1 acre, the remainder being grass land.

Cattle.—Dairy cows, 6; and a few young stock.

Horses.—Draught, 6; saddle and buggy, 3.

Pigs.—40, of various sizes, Berkshire and China.

*Note.—Mr. Rossiter was awarded 3rd prize. This farm was fully described in connection with the previous year's competition.

Poultry.—Fowls, 100; ducks, 40.

Implements.—1 corn-sheller, worked by horse-power, very complete; 2 sets iron harrows; 2 V harrows; 1 large 5-bore harrow, for breaking down land when very rough; 2 double furrow ploughs; 1 scarifier; 1 Hyde's cultivator, a very good implement on a farm; 1 horse hoe; 2 hilling ploughs; 1 chaff-cutter; 2 drays; 1 sack truck.

Buildings—The farm buildings are substantially built, and the general arrangements are very convenient. The outbuildings comprise a barn, good stables, cart-shed, a roomy hay-shed, piggeries, and yards, all of which are in good repair.

Oats are grown for hay, for which there is a good demand in town, but the growth of the crop is too rank and luxuriant. The main crop of maize and potatoes is chiefly sent to Sydney market. The butter, eggs, and poultry are mostly sold in town. The pigs Mr. Rossiter ships to Sydney market when there is no demand in Kempsey for them, and they realise a fair price at times. The general management of this farm is good. The crops are kept fairly clean, and the cultivation is good. Rotation of crops, good. Mr. Rossiter sows about 4 acres with barley; after cutting, reploughs, and then sows to oats for hay, and afterwards maize or potatoes. He also has about 4 acres of potatoes, after which he intends to plant to maize if weather permits. Mr. Rossiter has a natural supply of water, obtained from the river. The means of conserving fodder are good. The implements are all that are required, and are kept in good order. The manure heap is added to from the stable. The stock on the farm are good, and well attended to. The fences and gates are in a good state of repair. The books are very well kept.

The orchard and garden was rather neglected, although there were some fine specimens of pears and other fruit-trees in it at the time of my visit.

The crops were looking well, with the exception of a small patch on one side of the farm, which was slightly damaged by the recent flood, but by no fault of the industrious owner.

The farm is worked by Mr. Rossiter and his sons, with energy and perseverance to make the land produce all it can for profit.

*Shem Bartlett, "Farleigh," Rous, Wardell, Richmond River, recommended for 3rd prize.

This farm is situated about 7 miles from Wardell, and Mr. S. Bartlett holds a 134-acre farm, selected in 1878 under the conditional purchase clause of the Lands Act.

Cultivation.—Maize, 7 acres; sugar-cane, 11 acres; potatoes, ½ acre, of which that pest called the ladybird, devoured the greater part. Peanuts, 1 acre; sweet potatoes, ½ acre (two varieties); yams, three varieties; sorghum and imphee, 2 acres, mostly grown for stock, the rest being grass land.

Horses.—Draught, 2; brood mare, 1; saddle and buggy, 3.

Cattle.—Dry cows, 16; milking cows, 10; 1 Ayrshire bull; and a few young stock.

Pigs.—Twenty improved Berkshire.

Poultry.—Fowls, 40 white Leghorns.

Implements.—One 2 horse-plough; 2 harrows (1 V. and 1 No. 4); 1 hilling plough; 1 spring-cart; 1 buggy.

Buildings.—A fairly neat and compact homestead; but the outbuildings generally are not as good as I should like to have seen them, with the exception of the piggery, yards, and milking bails, which are very fair.

*NOTE.—Mr. Bartlett was awarded a Highly Commended Certificate.

The general management on this farm is good. The state of the crops as to cleanliness is good, the cleanest I have seen anywhere. The system of cultivation is fairly good, with the exception that Mr. Bartlett has made a very great mistake in trying to keep his maize too clean. after it has attained a certain age; in so doing he has disturbed the roots, which, I think, is not a good plan, and would recommend him to discontinue the practice in future. I would also recommend him not to plant so thick on his land. The system of rotation is good. The homestead is watered from tanks, and the pasture land by a creek running through the paddock. The means used for conserving fodder are fair, there being a small stack of hay. The implements on the farm are not as good as some I have seen, and only fairly kept. The manure made on the farm is carted on to the land, and I saw some good results from it, especially in the maize. The stock on the farm are only fair. The fences and gates are in a good state of repair, and are of a substantial character. The homestead is fairly good, but requires a little paint to preserve it. Cocksfoot and rye grasses have been laid down, and no doubt will prove very beneficial to the pasture. The books are very well kept. New crops are rice, chickpea, teocinte, mung bean, kaffir corn, and black sorghum, all looking well with the exception of the rice. Vegetable and fruit garden.—There are about 2 acres of mixed fruit orchard land, which is cultivated by horse labour between the trees, they being well pruned and looked after, and many of them are fine specimens. The following varieties I noticed growing, viz., mangoes, date plums, guavas, cherimoyers, walnuts, loquats, mulberries, apples, peaches, pears, pineapples, oranges, and bananas, of which he has some fine specimens of the Fiji variety. The milk is sent every day to the butter factory, for which Mr. Bartlett informed me that he receives 2½d. per gallon. Pigs, fowls, and fruit, help to bring their quota to the revenue of the farm.

The produce is disposed of at stores in Wardell.

The operations of the farm are conducted by Mr Bartlett and his nephew, with the exception of stripping the cane, and it is kept almost like a garden, showing that a great amount of energy has been displayed in bringing the farm from a dense brush to its present state.

Class II.—Over 200 acres.

*William O'Meara, Hickey's Creek, Kempsey, recommended for 1st prize.

The farm is situated 25 miles above Kempsey, and has a frontage to the Macleay River.

Mr. O'Meara has a freehold of 1,033 acres, the low land that adjoins the river being exceedingly fertile. The homestead is located on the higher ground, well above flood-water.

About 50 acres are under cultivation, the balance being grazing pasture and some of the land still timbered. The farm is abundantly supplied with water.

The general management of this property is very good, especially in the mode of cultivation.

Cultivation.—Forty acres of maize, half acre of potatoes, 1 acre of tobacco, 1 acre of lucerne, 1 acre of oats for hay, half acre of imphee, 1 acre of pumpkins and grammas, quarter acre of sunflowers. The varieties of maize grown on the farm are golden beauty, yellow hogan, Queen of the Prairie, white flint, chicken, and Hawkesbury. Pumpkins, 5 varieties, grammas, sunflowers, tobacco, piemelons, watermelons, 3 varieties; squashes, cucumbers, beet, 2 varieties; beans, 7 varieties; onions, mangels, potatoes,

* **Note.—Fully described in connection with the previous year's competition.**

5 varieties; barley, wheat, 6 varieties; oats, arrowroot, linseed, artichokes chicory, turnips, 2 varieties; peas, 2 varieties; Kaffir corn, broom millet, pearl millet, imphee, Hungarian millet, sorghum, 2 varieties; also pigeon pea, chick-pea, mung bean, Indian hemp, A. R. Rice, No. 1 rice.

Many of the varieties were sent to Mr. O'Meara from the Department of Agriculture, to experiment on, and I find that under his able management, they have done remarkably well.

Horses.—Six draught horses, 5 buggy horses, 8 blood horses, 2 hacks.

Cattle.—One hundred dairy cows, 330 young cattle, various ages.

Pigs.—Fifteen store and breeding sows; 1 improved Berkshire boar.

Poultry.—Two hundred fowls, and 30 ducks.

Bees.—Thirty-seven Italian stocks; 6 native stocks.

Implements.—One cultivator, 6 ploughs, 1 harrow, 1 roller, 1 chaff-cutter, 1 corn-sheller, 1 buggy, and various other implements, including ridging plough and corn planter combined.

Buildings.—A fair neat and compact homestead, with detached kitchen, 5 milking bails, 11 pig-styes, barn, implements, and buggy sheds, fowl-houses, large piggery, with ample supply of water, blacksmith's shop, and tool house.

Fences and gates.—Fences and gates are in good repair.

The pasture lands are fairly stocked with horses and young stores of various ages, all of which are looking fairly well.

The orchard and garden are attended to fairly well, as I saw some fine specimens of different varieties of fruit-trees, especially orange, clearly showing what can be done by careful cultivation. The orchard is surrounded by high poles, 30 feet above ground, armed with barbed wire 12 inches apart; this contrivance is very good for preventing the invasion of flying foxes, and is a great credit to the owner.

The milch cows supply milk for a Danish separator, No. 7, worked either by means of horse gear or hand power. The dairy is very small, but cool, being constructed with a double wall, and covered with shingles.

A honey-extractor separates the honey from the comb.

A great number of pigs are reared and disposed of annually. At the time of my visit I saw a fine lot of bacon, which ought to command a ready sale in almost any market.

The books are fairly well kept, and give evidence of intelligent and successful management.

William Alexander Stitt, Taree, Manning River.

Area.—Four hundred and sixty-five acres, freehold.

Cultivation.—Eighty-five acres of maize, 1 acre of potatoes.

Horses.—Eight draught horses, 5 light saddle and buggy horses.

Cattle.—Thirteen milch cows, 15 young cattle, various ages.

Pigs.—Twelve pure bred Berkshires, 18 cross-bred, various ages.

Poultry.—Two hundred fowls, 34 Cape geese.

Implements.—One maize threshing and bagging machine, capable of threshing 70 bags per day, 2 sulky ploughs, 1 double-furrow plough, 2 two-horse ploughs, 1 hilling plough, 2 harrows, 2 disc harrows, 1 horse-hoe, 2 farm drays, 1 buggy not very well kept.

Buildings:—The homestead is fairly good, but the outbuildings are not what they should be.

I also find that the maize and other crops are not well cultivated; one great mistake is hilling too deep, to smother weeds. I would recommend more attention to crops when young.

I do not think it of sufficient merit to award a prize.

Statement of Points gained by the various competitors.

	Maximum number of points.	Class I. J. W. Johnson, Southgate, Clarence River.	Hugh McLachlan, Grafton, Clarence River.	E. Rossiter, Kempsey, Macleay River.	Shem Bartlett, Rous, Wardell, Richmond River.	Geo. Morrison, Chatsworth I., Clarence River.	D. McLennan, Taree, Manning River.	Jno. Stitt, Taree, Manning River.	Jos. Saunders, Smithtown, Macleay River.	Robt. Robinson, Rous, Richmond River.	Albert Eggins, Grafton, Clarence River.	W. C. Stewart, Warneton, Macleay River.	Arthur Harris, Gladstone, Macleay River.	Class II. Wm. O'Meara, Hickey's Creek, Kempsey.	W. A. Stitt, Taree, Manning River.
		Divide 1st & 2nd Prizes.		3rd prize.										1st Prize.	
General management, with a view to profit	125	115	120	115	115	115	100	115	115	115	110	115	60	115	90
State of crops as to cleanness and cultivation	100	85	95	85	90	90	75	85	85	95	85	75	40	90	85
System of cultivation, rotation, &c.	80	70	65	70	70	70	55	70	65	70	65	65	40	70	60
Number and condition of subsidiary aids to farm ...	80	70	70	70	70	65	70	70	70	65	65	70	30	75	65
Conservation of water and its economic application ...	80	50	60	20	20	50	40	70	65	30	30	10	10	70	40
Means used for conserving fodder	60	45	...	40	35	...	45	35	...	...	35	30	...	35	20
Kinds of implements used, condition, &c.	60	60	60	55	30	50	45	25	25	30	40	20	10	50	45
Productiveness of crops	50	40	45	50	35	40	40	40	30	45	35	40	25	40	40
System of underground drainage	50*	20	not reqd.	10	not reqd.	40	25	...	...	not reqd.	5	10	...	...	...
System of manuring	50*	20	30	not reqd.	30	20	...	20	20	...	15	...	...	25	25
Conservation of manure made on the farm	50	20	...	10	20	...	35	...	25	...	10	...	...	35	...
Class and condition of stock	50	40	50	45	30	40	40	40	30	45	40	40	20	40	35
Character and condition of fences and gates	40	35	35	35	30	30	35	30	40	35	30	30	20	30	25
Plan, character, and condition of farm house, buildings, &c....	40	30	35	35	30	40	30	30	30	25	25	25	15	30	30
System of laying down grasses	20	...	...	5	10	...	15	10	...	...	10	5	...	5	...
Mode of book-keeping	20	10	10	20	15	10	10	10	10	10	...	20	...	20	5
Any new point of interest and commercial value, such as new crops, ensilage, &c.	20	..	...	...	10	...	...	...	5	..	...	...	...	15	...
Vegetable and fruit garden	25	15	15	15	20	10	10	15	15	15	10	...	5	20	10
Total	1,000	725	690	680	660	670	670	665	630	580	610	555	275	765	575
Percentage of excellence	...	72.5	72·6	71·5	69·4	67·0	67·0	66·5	63·0	61·05	61·0	55·5	27·5	76·5	57·5

Best Cultivated Acre of Wheat.

A. BRUCE-SUTTOR, Judge.

In reporting on the respective acres of wheat entered this season for competition for the National Prizes offered by this Department, I found that although there were in all fifteen entries, out of that number there were only four competitors, the withdrawal of a majority of the entries having been mainly due, it has been alleged, to the crops having become damaged by adverse weather, and on that account some crops which might have taken very good positions were unfortunate. A notable instance was Mr. C. Loiterton's acre at Cootamundra, which was in every other respect worthy to compete. Mr. R. Andrews, in the same district, had also a good crop, but it was slightly injured by the weather, and as it was found to be under the stipulated area it was considered ineligible.

The farmers generally did not anticipate the requirements of the Department for judging the acres of wheat, and they consequently had not made timely provision for cutting and threshing on the same day a representative portion of their crops, and exception was taken to the inconvenience caused through such having to be done. Under ordinary circumstances, the wheat would, as a matter of course, be cut and allowed to remain in stooks for some time before being threshed, but as that system was, in fairness to all competitors, found to be impracticable in deciding the relative merits of each acre of wheat in different districts in the Colony, it was deemed advisable to conduct the judging as already explained.

But, in consideration of having to so deal with wheat crops in determining their respective merits, the attendant difficulties in getting the grain threshed out in its comparatively green state, the expense, and the inconvenience of the judge being obliged to be present at the harvesting of each crop, I cannot advise that the prizes should be continued to be offered for the same class of exhibit under the same regulations as last year. The competing crops have not, as a rule, shown any marked degree of excellence and the cultivation in some cases was not by any means all that could be desired, nor were the yields as large as might have been expected from a better system of agriculture than that generally adopted As, however, the competitors are fairly representative of the Colony, I beg to recommend for the Minister's consideration the following awards:—

1st prize, £15.—Thomas Bragg, Allington, Narromine.

2nd prize, £10.—C. Limberg, Rob Roy, Inverell.

Mr. Bragg, whose station is situated about 12 miles from Narromine, is one of the selected men who last year set apart 10 acres for the purpose of experimenting with various kinds of wheats for this Department, with a view to determining rust-resistant varieties, and, so far as can at present be judged, he is one of the most painstaking and one of the most successful experimentalists. On the greater portion of his experimental area the seed was sown by a drill machine, which gave his wheat a neater and more regular appearance than the same crop at other places where a similar mode of sowing had not been carried out. Rust was slightly apparent throughout the crop, though it was not sufficient to visibly affect the grain. The variety of wheat exhibited was that known as Blount's Lambrigg, which was included in the assortment of seeds sent to Mr. Bragg by this Department for trial purposes. The yield was $38\frac{1}{3}$ bushels per acre, which may be considered as a good production for this Colony, and it was the highest yield of those competing. Mr. Bragg would, however, have preferred to have chosen for competition an adjoining plot of Smith's Nonpareil wheat, as it had a more

even growth and had the appearance of being an excellent crop, but it had to be excluded in consequence of the area being insufficient. It must be a source of some satisfaction to this gentleman to have his acre of wheat in such a state of efficiency as to be worthy of recommendation for first prize, as when he at first entertained the idea of cultivating wheat crops so far west as his farm is situated he was dissuaded from entering on such a venture by his friends, the district being then regarded as not at all suitable for the operation. The soil is a deep red loam of a good character, though, during the dry weather in hot summer months, it becomes too hard to turn over with an ordinary horse-plough, yet it is easily ploughed when moistened by rain, and the soil being friable it can be kept in good tilth, and by judicious management excellent results may be obtained.

Mr. C. Limberg's farm is situated about 7 miles from the township of Inverell, his acre of wheat, which is recommended for second prize, is also Blounts' Lambrigg variety, or a very similar wheat, and the yield was 33⅘ bushels per acre. Though the quality of the grain was not so good as that of Mr. Bragg's, nor the yield so heavy, the production of straw was greater, and it was also clean showing only a slight appearance of rust. The soil is a rich dark loam containing an abundance of plant food, and the deficiencies in the crop must be accounted for by inadequate cultivation and to the need of drainage which was very apparent. Had a better method of farming been adopted it is quite probable that the recommendation for the prizes would have been reversed. The Inverell district has a much larger rainfall than the Narromine district, and the natural facilities for cultivation are consequently greater than at the latter place.

TABLE showing the points obtained by the competitors:—

	Maximum.	T. Bragg, Allington, Narromine.	C. Limberg, Rob Roy, Inverell	E. Taylor, Rose Hill, Young.	F. Jackes, Iranistan, Armidale.
Cultivation and cleanness of crop	20	18	14	15	12
Evenness of crop...	10	8	10	7	6
Value and weight of straw per acre	10	8	10	4	7
Weight of grain per acre	40	25	22	15	20
Commercial value of grain	20	15	13	20	12
Total	100	74	69	61	57
Percentage of excellence	...	74%	69%	61%	57%

DAIRIES.

F. M'CAFFREY, Judge.

I HAVE the honor to state that, in accordance with the Minister's directions, received last October, I have judged the dairies entered for competition for the prizes offered by the Department for the year 1892. Although the prizes were open to all districts of the Colony, I regret to say that there were not more than nine entries. Of these three were from the district of Ulladulla, Illawarra sent two, Goulburn one, Menangle one, Bega one, and Tumut one,

The judging, as directed, was strictly on the point system, and, as far as possible, was from a practical dairyman's point of view.

Four classes of dairies were included in the nine which competed, viz., dairies which treated all milk obtained on the farm, of these there were five; dairies which dealt with part of the milk, some being sold, of these there were

two. One dairy sent all the cream to Sydney to be converted into butter; and a dairy, which sent all the milk obtained on the farm to a factory, except in the case of Sunday's milk, which was made into butter on the farm. In each case, however, the points allotted in the papers forwarded herewith, were given on the consideration of the dairy's capabilities to treat the full quantity of milk produced on the farm.

The maximum of points for a perfect dairy was 1,000, and it affords me pleasure to state that in one case, that of Tooth's Island Dairy, Kameruka, the allotment made a total of 875 points, and thus I have recommended it to receive first prize.

The next in order of value in the points scale is the dairy of John Lindsay, Kembla Park, Unanderra, which obtained 655 points. This dairy, like Tooth's, has two complete plants, one for cheese-making and one for butter-making, and, therefore, has taken the share of 100 points available for a cheese-making plant, as well as the 100 points for butter-making. H. W. Mason, of Tumut, who is the only other competitor who has two plants, scores 615 points. But A. F. Warden, of Milton, who has only one plant, which is for butter-making, scores 645 points, an admirable result. Of the remaining dairies the highest in point of merit is A. J. Onslow Thompson's, which has 635 points, a very good result, but this dairy is actually a factory, which has thirty suppliers, and which sends its cream for treatment to Sydney.

According to the point system, as allotted, J. Lindsay appears to be entitled to the second prize. It is a clean, well managed dairy, but has not the perfect surroundings which are special features in the case of Tooth's Island Dairy at Kameruka, nor are Mr. Lindsay's appliances in connection with butter-making of the most modern kind.

Description of Mr. Tooth's Island Dairy, Kameruka.

The main rectangular building, 60 feet x 24 feet, divided into separating, churning, butter-making, and cream divisions. The milk of about 500 cows is received daily, morning and evening, during summer months, and once a day during winter months, and operated upon under most advantageous conditions. Having been measured, the milk is strained and allowed to flow from an outside raised porch into two large double-cased cheese-vats, capable of holding 500 gallons of milk each, and which stand on a platform or floor, raised 3½ feet above the general or lower floor level. The temperature of the milk having been regulated by means of steam or cold water it is permitted to run into two De Laval separators, Alpha No. 2, machines, capable of separating 300 gallons of milk per hour each.

The whole building has a ceiling 20 feet high, which is very fairly ventilated.

Standing over the cream-room are a number of large tanks of clean, cold, filtered water, 1,600 gallons, which is available for all internal uses, such as butter-washing, cooling cream, &c. The cream is passed through a tin shoot in ceiling of cream-room, over a Lawrence cooler, into large double-cased tin vats within the room, so placed that when the cream is ripe for churning it can be drawn off through an opening in the wall direct into the churn.

The walls, doors, ceiling and floor of the 18 feet x 10 feet cream-room are double lined with matched timbers, and filled with 10 inches of charcoal, and the room is provided with good ventilation, and being completely within the main building, it has an advantage in temperature in all seasons.

Two large archimedean churns, a new idea in the way of butter-making, treat the cream, and can turn out 400 lb. of butter each. This invention, according to Mr. W. W. Wren, the manager of Kameruka Estate, is by far the best churn yet introduced. It is driven with less power, and can never

over-churn the butter, neither does a particle of cream escape unchurned, so that a better percentage of butter is obtainable than by any other churn. A cooling and heating appliance is provided, so that the temperature of the cream is reduced or varied at will during the process of churning.

Description of Churn.—It consists of two compartments not necessarily of equal holding capacity, one part is cylindrical, and has two archimedean propellers revolving in it at a speed of about seventy-five revolutions per minute, also a tubular refrigerator or heater as the case requires. When in use one propeller forces the cream over this refrigerator or cooler, whilst the second draws it away and dashes it against the end of the cylinder, from whence it passes into the second box and back to first propeller, through spaces arranged to facilitate a regular flow of cream; this process continues until every particle of cream is churned. The small particles of butter remain floating in a granular form in the outer box; and cannot get over-churned. The buttermilk is easily run off, and sufficient water is added to remove the least trace of buttermilk. The newly-churned butter is taken on a butter-waggon into the butter-working room, 19 ft. x 24 ft., which, like the other compartments, is lined throughout with matched pine, varnished or neatly painted. Two large lever tables are used at present for working and salting the butter, but are being replaced by the circular butter-worker. The butter is either packed for chilling in boxes with the necessary butter-paper, or in 60-lb. kegs for market direct. A marked feature at the Island dairy in the working machinery is the absence of shafting and pulleys in the several rooms, as a result of this arrangement no dust or grease is to be seen in the apartments. The shafting is carried beneath the raised floors, and in a dry cellar used for storage purposes, and a system of fast and loose pulleys operated by simple levers sets any part of the machinery required in motion. A brick and cement tank (underground) is kept daily filled with pure filtered water, and contains 7,000 gallons; this in turn supplies elevated tanks and refrigerating machinery. A small boiler and Tangye pump (steam) fills the tank from the "sump," in the bed of the Tantawanglo River, 250 yards away, and 147 feet below the dairy. An 8-horse-power colonial Tangye boiler and 6-horse-power engine drives separators, churns, and pumps from two underground tanks near the building to the elevated tanks in the dairy, and provides steam for a Bailey steam kettle, which is placed under a 9-foot verandah, adjacent to the wash-up vat, by this means all the utensils and appliances in connection with the dairy are washed and steamed. There are two boilers and engines with two separate boiler and engine-rooms in connection with the dairy. A complete freezing plant is in daily use, and upwards of 9 tons of butter are stored at present, which will be increased to 20 or 30 tons during the next few months. This will doubtless be placed on the market during the winter months. One of Lightfoot's dry-air machines, driven by a 16-horse-power boiler, is used for this purpose, and is most reliable and efficient. The insulation of two chambers, each 13 feet x 13 feet x 6 feet, is very thoroughly provided for; the walls of this building are made thus:—double brick walls set in cement, and having a 3-inch air-space between them, then 12 inches charcoal, with another 3-inch air-space, followed by 4 inches of ground charcoal, one thickness of felt, backed by matched, tongued, and grooved pine painted and varnished, double floors and ceilings, with 12 inches charcoal, a thickness of felt and matched boards ensure the least possible escape of cold air from these very perfectly insulated rooms. A double-walled ante-room and two store-rooms are also provided above the cold-air apartments. The advantages of this freezing room enabled the manager to net 1s. 2d. per lb. for all butter

produced during the year 1892. These results speak for themselves. The weather trouble is overcome by artificial means. Another marked feature in this dairy is the ease with which the skim-milk is conveyed to the piggeries and calf pens. The separated milk flows along troughs, which are washed out every day, some distance away from the dairy on the slope of the ridge upon which the dairy is erected.

The cheese-making is carried on upon the Canadian Cheddar principle.

Mr. John Lindsay's Dairy, at Unanderra.

This dairy is constructed of double-thickness brick walls, with cement floor, and double doors and windows, sawn shingled roofing. The dimensions of building are 45 ft. x 25 ft. x 12 ft. The ceiling is lath and plaster, which is raised 4 feet higher than the collar-ties, giving additional height to walls of dairy. This dairy has not the modern appliances or superior fittings of Mr. Tooth's Island dairy, nor has it the neat butter plant which is to be found in Mr. Warden's dairy; but it is undoubtedly a splendid building, with very good surroundings.

As a prize-taker at agricultural exhibitions in dairy produce sections Mr. John Lindsay's name is a household word.

The co-operative system of dairy-farming has been such a marked success throughout the dairying centres of the world, and more especially along the South Coast districts of New South Wales, that to find a dairyman manipulating milk on his farm has certainly become the exception, not the rule. A dairy-farmer of the present day saves himself the expense of erecting a dairy, which means considerable outlay in order to keep pace with the times, by taking up ten or more shares in a co-operative dairy company, the deposit on which very often does not amount to more than 5s. per share. Hence that wide-spread interest which was raised in the erection of dairies ten or fifteen years ago is dying out, and co-operative factories are taking their place. Of course in sparsely-populated districts, where dairy-farming is carried on, private dairies must be erected.

The introduction of the cream separator has almost entirely done away with the old pan-setting system. According to this system a large room was required in which to set the dishes or pans, besides having a butter and churning room. The separator takes up but little space as compared with the pan-setting system. Hence the dairies of the present day are only erected of one-half the dimensions of former years, except in the case of cheese-making dairies. There are many opinions expressed and ideas suggested about the best kind of dairy. Some prefer wood, others stone or brick; while others consider a building part or all underground the best kind. Nearly all are agreed on a cement floor, provided it is properly made. But the kind of roofing best adapted to our climate brings forth another difference of opinion. Some prefer iron, as it cools so quickly, forgetting that it is liable to heat equally as quick. Some prefer a double roof, which is, as a rule, very expensive, and out of the reach of many farmers. The object of the dairy-farmer is to have a dairy erected that will resist the sun's rays in summer, and the cold winds in winter. A moist air is not beneficial to either butter or cheese-making; a dry cool air is required. This desirable result cannot be brought about if the drainage is deficient or the walls damp. The building should be constructed in such a way that the machinery may be run with as little shafting as possible to prevent accidents and reduce the driving power required. Having all these objects in view, I consider Mr. John Lindsay's dairy, so far as a building is concerned, comes as near perfection as any I have seen, as it is within the reach of an ordinary dairy-farmer.

DAIRIES IN COMPETITION.

	Maximum number of points.	R. L. Tooth, Kameruka, Bega. 1st Prize.	John Lindsay, Kembla Park, Unanderra. 2nd Prize.	A. F. Warden, Sunny Side, Milton.	A. J. O. Thompson, Camden Park Estate, Menangle.	H. W. Mason, Tumut.	George Gear, Tullimbar, Albion Park.	D. W. Pearman, Milton.	W. H. Wilford, Loch Leven, Milton.	Fred. Shepherd, Goulburn.
Site	100	80	80	70	80	65	75	75	80	70
Buildings	100	95	85	80	80	40	70	73	70	40
Fittings	100	80	65	80	70	75	70	70	60	40
Cooling appliances, such as fans, and underground pipes.	100	100	20	20	30	30	30	......	......	......
Ventilation	50	35	35	35	35	35	30	35	35	30
System of drainage in and around buildings ...	100	95	70	60	60	55	70	70	70	60
Water supply and means of application ...	100	90	60	80	70	80	60	60	60	60
Appliances for cleaning utensils	50	50	30	40	40	30	30	35	30	30
Plant, such as churns, butter-workers, vats, presses, pails, &c., &c.	200	160	120	90	80	125	75	80	60	75
Condition of dairy, as regards cleanliness, general order, &c., &c.	100	90	90	90	90	80	90	90	90	80
Total	1,000	875	655	645	635	615	600	583	555	485

Dairy Farms.

F. M'CAFFREY, Judge.

I have the honor to submit my report on the National Prize Competition for dairy farms on the north and south coast districts of New South Wales. On the north coast district there were three competitors only, which were far apart. One was at Singleton, and it may be fair to mention that this farm was entered in the wrong class as it is undoubtedly a mixed farm, and two were in the Richmond River district.

The great area of dairying country lying between the Hunter River and the Tweed should have commanded many more entries. There should have been competition from the Hunter, Paterson, Williams, Manning, Hastings, Macleay, Nambucca, Bellinger, Clarence, and Tweed Rivers, together with their many tributaries. But this cannot be wondered at when the south coast, with its long association with the dairy industry, only sent an exceedingly small number of entries from such a large number of dairy farms. It impresses one with the idea that the sole object in view is to get as much as possible out of the farms in the shortest given time, without expending anything on improvements. It is common to hear a farmer remark, "I would enter my farm only the fences are out of order, and I have no gates on my paddocks."

During the last two years dairying has extended all over the north coast districts. The establishment of Messrs. Ireland's creamery at Newcastle has given a market to all the Hunter Valley. The establishment of a similar one at Byron Bay will be a matter of the near future. Other districts have entered extensively into the factory system, and probably it was the absence of first-class dairy stock which caused farmers of the north to refrain from entering into the dairying industry up to this time, and dairymen from entering in the present competition.

I would remark that the present great draw-back to dairying is the difficulty experienced by holders of land in many parts of this Colony in stocking it with good dairy stock. Before dairying can be brought to a fair position in this Colony it will be necessary to develop or enlarge what may be termed the breeding interests. Good stock can be bred from the many excellent herds to be found at present on the south coast, without introducing new stock from abroad, but, as an increase is required speedily, imported stock might do special service. In carrying out this, however, it should be the object of importers that the stock which is brought here must be from the fountain head or pure font. No cross-bred bulls, no matter how presentable they are, can be serviceable. There is a good foundation to work upon, hence it devolves upon all honest breeders of dairy stock not to lessen this by the introduction of cheap (so called) pure breeds.

I would specially direct attention to the present situation. There is a strong demand for good dairy stock, and these are not plentiful. It is not likely the owner of such will part with them at anything except extravagant prices. The position must be met by the exercise of knowledge and skill in selecting and breeding. There must be great care exercised in culling, also in mating.

Among so-called beef breeds there is a small proportion of good milk-yielding cows. These should be mated with the best of dairy bulls. The object should be to improve each succeeding generation, and bring it up to a certain degree of production. The man who starts with a herd which yields not more than 1 gallon of milk per day each on the average, will have amongst it cows which will yield 2 or more gallons per day. These should be carefully conserved, and their off-spring well tested. As the herd grows, young heifers of a good kind will displace the small yielding old ones. A dairy farmer requires a good extra run to carry out this principle, but it is one which in the end is bound to succeed. The man who is limited in area has to depend solely on his judgment in purchasing suitable stock, whereas if he could rear a number of young stock each year from his best cows, and cull out the bad ones, he would find himself in the course of a few years the proud possessor of a first-class herd of dairy stock.

The owners of the farms in competition for the 1892 prizes show a pleasing desire to conserve dry fodder, and this is an instance of advancement upon last year's report. But in preserving green fodder there is a lamentable defect. Ensilage is neglected, and when the competitor is asked why such is the case, he replies, "I don't believe in ensilage." The bald statement that the best system of preserving green food is worthless should not be accepted, while other countries have proved that silage is valuable food for cattle in dry and cold seasons. Men clamour for experience and experiments, yet in the face of these facts they condemn a valuable stand-by in case of hard times, without giving it a trial. If these men would give silage a fair trial they might, even by doing that, confer a boon on many of their fellow cattle-owners in this Colony, and perhaps in other parts of the world their experiments would be valued.

It will be seen from the allotments of points that no first prize is awarded in the section for the North Coast dairy farm. The reason for this is that out of a possible 950 points the highest score made is by the dairy-farmer, whom I have recommended for second prize. He scores 580 points, and the strongest features of his farm are the general results and management.

These are of great influence in making an award, although results are not stated in the scale of points. Good management bears such an important relation to good dairying that the scale should be amended in this respect, and instead of giving 80 points for it, it would be well to raise it to 100 points.

The total score of Mr. William Noble's farm, Fernleigh, Tintenbar, Richmond River, is too far below what I regard as a fair proportion out of 950 points to award a first prize. I should mention that he has been but a short time engaged in dairying on the farm which he entered for competition.

Mr. Walmsley's farm at Midgegrass, Lismore, Richmond River, was judged rather at a disadvantage, owing to its being thrown open by railway construction operations, but farms must be judged on their present qualifications, not what they have been or what they may be again in one or a number of years hence.

In the South Coast competition, with farms up to 200 acres, there were 4 entries, three of which make a fair score of over 600 points. The smallest score of the three is by George Whiteley's farm, Tathra, Bega, who has 610 points out of a possible 1,000, which includes 50 points for drainage; but in the case of Mr. William H. Swan's farm, at Albion Park, which scores 670 points, and Mr. George Gear's farm at Tullimbar, which has scored 640 points, there was no drainage required, and hence the possible score in each was 950 points.

Mr. Swan, who is recommended for first prize, has what may be termed an excellent herd of cattle. The farm and pasture are of high quality. All the manure of the farm is saved, and properly utilised, and a large quantity of green food is provided in case of scarcity. He scores low in general management, having only 55 points out of a possible 80. The cause of this is mainly because he is a tenant. Fences and out-buildings are much below the standard of the farm's present production. Although he has rented this farm for a number of years, his terms of lease have not been extended over three years. This causes uncertainty, and prevents him entering on an outlay for improvements. The returns from the farm are good.

Mr. George Gear, of Tullimbar, Albion Park, who is recommended to receive second prize, has a poor hilly farm, subject to many disadvantages, but he has practically overcome them by general management of a superior kind. His buildings, fences, gates, and plan are of an admirable kind. Cattle pasture and water are his drawbacks. These leave him below but close to the score made by Mr. Swan.

The value of Mr. Gibson's farm at Brownsville was materially lessened by the presence of weeds, and his general management was not good. His cattle were of very good quality, some of his dairy cows especially being of a high standard.

Mr. Whiteley's farm, at Tathra, presents quite a contrast to the latter farm, and has the appearance of very good general management, but its lowlands were unavoidably under water. An extensive system of drainage on co-operative principles would certainly be required to save this farm from having a large extent of its flat land periodically flooded.

In Class II, South Coast, farms over 200 acres, there were only three entries—one at Unanderra, close to Wollongong, one at Milton, in the Ulladulla district, and one at Wolumla, in the Bega district.

Two of these have a pleasing record of marks on the point scale. Mr. A. F. Warden's farm, Sunnyvale, Milton, scores 785 points out of a possible 950. This farm secured second place in the 1891 competition; and the fact that in the present competition it is recommended for first place reflects credit on the improved management and care. As in the case of last year it is shown that Mr. Warden is the only farmer in the competition who provides shelter for stock. He thus scores for this twenty points, whereas in the cases of all the other competitors the line "Plan of sheds for housing

cattle" is a blank. In cattle, providing green fodder, and preserving fodder he scores 240 points out of a possible 280. And in the provision of water and its application, he makes the admirable score of 70 points out of a possible 80.

Mr. John Lindsay's Farm, Kembla Park, Unanderra, is recommended for the second prize. In cattle he has the creditable score of 90 points out of a possible 100; but it is in fences and gates and general details that weakness is apparent. His score of 675 points could, by a few improvements on the farm, be materially increased in future competitions. Management for profit is a strong and pleasing feature on this farm.

Mr. J. M. Black's farm, at Wolumla, Bega, who is recommended for honourable mention for general management, has a small number of milch cows on a very large extent of country. He has not a farm that will stand cultivation, hence no provision is made for growing or conserving fodder. The cattle have to depend principally on the natural grasses. But what can be done with the farm he has accomplished, and hence I consider his management all which it should be under such disadvantageous circumstances. Mr. Black has adopted a novel system of conserving water around his premises which is worthy of notice. Sixty-two square iron tanks, 400 gallons each, are all connected by means of pipes and taps with all his buildings, where water is required.

I would wish also to draw your attention to Mr. Geo. Gear's milking bails, "Tullimbar," Albion Park, the flooring of which is made of concrete. By this means every portion of manure, especially the urine, may be conserved from the bails. When the milking is completed the bails are washed out with water, and kept perfectly clean. The concrete in this instance is in perfect condition. In future competitions I would suggest that competitors should be requested to state the exact area of their holdings when sending in their entries. It is most difficult for a judge to determine the value of a farm or to place the scale of points correctly, when the products of other holdings, either adjoining or in the immediate neighbourhood belonging to the competitor may be by mistake added to the capabilities of the farm entered for competition.

Dairy Farms.

	Maximum number of points.	North Coast District. Class I up to 200 acres. William Nobb, Fernleigh, Tintenbar, Richmond River.	William Walmsley, Midgegrass, Lismore, Richmond River.	Mrs. M. J. Brady, Mount Hope, Singleton.	South Coast District. Class I up to 200 acres. William H. Swan, Albion Park.	George Gear, Tullimbar, Albion Park.	George Whiteley, Tathra, Bega.	Edward Gibson, Brownsville, Dapto.	South Coast District. Class II over 200 acres. A. F. Warden, Sunnyside, Milton, Ulladulla.	John Lindsay, Kembla Park, Unanderra.	J. M. Black, Wollumla, Bega.
		2nd prize.			1st prize.	2nd prize.			1st prize.	2nd prize.	
Quality and breed of dairy cattle	100	65	60	45	90	65	75	80	80	90	65
Best system of providing green and root crops for winter food, having in view their milk-producing qualities	100	75	50	...	80	65	...	75	80	80	...
Best means of preserving fodder	80	50	70	60	60	60	70	50	80	60	...
Best system of conserving and applying water	80	60	70	50	50	30	40	40	70	40	70
Best system of conserving manure made on the premises	80	...	...	...	60	70	70	...	60	40	75
Convenience and completeness of milking sheds and dairy, and sanitary arrangements	80	60	70	30	50	70	40	40	70	70	70
General management, cleanliness, and neatness...	80	70	50	50	55	70	70	50	70	70	75
Underground drainage, where necessary...	50*	*	*	20	*	*	40	*	*	*	*
Quality of pasture and convenience of paddocks	50	40	30	30	45	25	25	30	40	40	35
Best system of rearing calves by hand	50	30	30	15	30	30	30	35	35	35	35
Character and condition of fences and gates	50	30	30	30	30	40	30	30	40	25	40
Plan, character, and condition of sheds suitable for the housing of cattle in winter...	40	...	...	...	...	...	...	...	20	...	...
System of laying down artificial grasses	40	30	25	20	35	25	25	25	35	35	30
Subsidiary aids to farm	40	30	25	30	35	30	35	30	35	30	25
System of book-keeping	40	20	20	15	20	30	30	20	30	30	40
Suitability and condition of implements and machinery	40	30	40	30	30	30	30	30	40	30	40
Total...	1,000	590	570	425	670	640	610	535	785	675	600
Percentage of excellence...	...	62·1	60·0	42·5	70·6	67·4	61·0	56·3	82·6	71·0	62·6

* **Note.**—The prizes will be awarded to the entries gaining the highest percentage of excellence—not necessarily the greatest total of points. Thus, in the event of any of the improvements indicated with an asterisk (*) being deemed by the judge unnecessary on any competing farm, the point allotted to that subject will not be included in the total maximum of points, and the percentage of excellence will be calculated accordingly.

Thus, a competitor who gains 760 points on a farm that is judged to need artificial drainage would receive a mark of excellence, 760 out of a possible 1,000—equivalent to 76 per cent.; but a competitor gaining the same number of points on a farm that is judged to need no artificial drainage would receive a mark of excellence, 760 out of a possible 950—equivalent to 80 per cent.

How to Increase the Percentage of Butter Fat in Milk.

By THE DIRECTOR OF AGRICULTURE.

THIS question is occupying the minds of many of our most intelligent dairy farmers in New South Wales, and each answers it according to his own experience. Many of our South Coast dairymen consider that they can increase the percentage of butter fat by using bran mashes, others by the use of ensilage, others, again, by the aid of Swede turnips, or linseed cake, or ground maize. They are probably correct in believing that they can thus increase the total output of butter from their farms, because they increase the production of milk by means of such valuable adjuncts to the natural grasses, but the result of a long series of experiments at the Wisconsin Experimental Station, U.S.A., seems to indicate that the percentage of butter fat depends upon the breed of the cow, and it does not vary to any material degree whatever kind of feed may be used, but that the flow of milk can be greatly increased by judicious feeding, although its actual composition as to fat, casein, water, and mineral matter will vary very slightly in any individual cow. Other dairy farmers, recognising the value of breeding, pin their faith to special breeds of cattle which have given them satisfaction in the past. Some of the best men around Bega will have nothing but the Jersey, others in the Ulladulla and the Illawarra districts have faith in the Ayrshire for its butter-producing qualities, while others, again, of our most successful dairy farmers have implicit confidence in the judicious selection and breeding of the graded shorthorns, now recognised as a distinct type by the name of the Illawarra breed, and some Richmond River dairymen consider that they get the best possible results from cross-bred cows between Herefords and shorthorns.

The question which of these breeds is the best for butter-producing, and which best for the output of milk without regard to butter percentage, will probably never be settled until an experimental farm has been started, the sole aim of which will be to compare these different results, produced under exactly similar circumstances over a long series of years.

The mere opinion of one man, or section of men, as to the relative merits of any breed of cattle, is of no practical value unless the breeds to be compared have been treated in exactly the same way, and the observations have been made with scientific accuracy.

But we propose to deal with the question now submitted for consideration entirely from the point of view of managers of factories and creameries, who only wish to get as much butter as possible from the milk submitted to them. From their point of view we have no hesitation in saying that the best milk enricher ever discovered has been a reliable milk tester, such as the Babcock or the Butyrometer or the Weigel Tester.

It is perfectly wonderful to note, in the light of experience from America, where these machines are very largely in use, how rapidly the butter percentage rises when the milk suppliers have once thoroughly grasped the merits of the principle, payment by results. It is recorded that in one large factory the average during April for four years preceding the use of the Babcock machine was 3·98, and during the April when it was first used that percentage jumped to 4·41, making each gallon of milk more valuable by more than ½d. The average for May during the four previous years had been 3·81, which became 4·07 after the introduction of the Babcock machine; the June average rose from 3·87 to 4·20; for July it had been 3·94, and suddenly rose to 4·22; in August it had risen from 4·19 to 4·43; September showed a rise from 4·36 to 4·59, and October from 4·62 to 4·91. Thus the gain in six months was as follows:—For April, ·43; May, ·26; June, ·33; July, ·28; August, ·24; September, ·23; and October, ·29—the average for six months being about ·29 per cent., which means nearly 1lb. of butter for every 30 gallons of milk. We know of no bran or ensilage or linseed cake that has effected such a wonderful improvement in such a short space of time.

On the score of common justice it cannot be denied that a man, who by means of his judicious breeding, whether with Jerseys, Guernseys, Ayrshires, or graded shorthorns can produce milk with 5 per cent. of butter-fat should not be paid at the same rate per gallon as a man whose inferior cattle can produce milk with only 3·6, or even as low as 2·8 per cent. of butter-fat.

A good deal of doubt has been expressed in this Colony as to whether any of these machines now offered to the dairying community are sufficiently accurate for practical purposes. From experiments made, not only in factories but in the chemical laboratory where the Babcock has been tested alongside the most approved chemical methods, we have no hesitation in saying that it is almost as exact as the best chemical methods employed, and sufficiently accurate for all purposes in the factory or creamery.

The following results, gained by a careful test, recorded by Mr. W. M'Veigh, manager of the butter factory at Geelong, in connection with a grand prize test at Warnambool Show will indicate how the practical results with the churn, as given by him, corroborate the indications of the Babcock. The grand champion prize was offered for the cow yielding the best weight of butter, the result of two milkings. There were fourteen entries for the prize. Each cow's milk was separated twice and churned at a temperature of 58 degrees. The Babcock tester was manipulated by Mr. R. Crowe, manager of the Keroit Butter Factory, and the results are herewith tabulated, showing the weight of milk from each cow, the butter percentage as indicated by the Babcock, the amount of butter which was expected from this test, the exact weight churned, and the percentage of cream indicated by another

machine, which some people erroneously suppose able to indicate the butter value of any sample of milk.

Number of each test.	Weight of milk.	Babcock's		Weight of butter churned.	Cream test.
		Butter-fat test.	Butter computed.		
	lb.	per cent.	lb. oz.	lb. oz.	per cent.
1	50	3·2	1 9½	1 8½	7
2	47	3·15	1 7½	1 7½	9
* 3	49	4·2	2 1	2 2	9
4	54½	3·6	1 15	1 15	8
5	45½	3·4	1 8½	1 11½	10
6	40½	4·6	1 14	2 0	11
7	36	2·8	1 0	0 15	5
† 8	42	5·0	2 1½	2 3	16
9	37	3·3	1 3½	1 4½	8
‡ 10	49	4·6	2 4	2 5	13
11	43½	3·6	1 9	1 12½	13
12	44	3·8	1 10½	1 11	11
13	27½	4·1	1 2	1 2	11
§ 14	42	5·3	2 3½	2 4½	16

* Fourth Prize. † Third Prize. ‡ First Prize. § Second Prize.

In the first place we may note how very closely the estimated yield, according to the Babcock tester, tallies with the actual yield from the churn. It must be remembered that the Babcock indicates only the pure liquid butter, and is therefore generally below the actual yield of the churning, which always includes more or less extraneous matter besides the butter-fat. Experience has shown that the percentage of 3·6 on the Babcock is generally equivalent to 4 lb. of butter for every 10 gallons, or 100 lb. of milk. The average of 302 analyses of butter has shown the percentage of butter-fat to be 84·39, so that one pound of butter-fat represents 1·185 pounds of butter (salted).

The second point to notice is the wide difference in value between these fourteen cows from the factory point of view.* No. 10, which took first prize, gave a good yield of milk—49 lb., and a good percentage of butter fat—4·6, with a total result of 2 lb. 5 oz. of butter. But its percentage of cream is only 13, while the winner of the second prize has a smaller yield of milk—42 lb., but a much higher percentage of butter-fat—5·3, and is therefore only half an ounce behind in the total yield of butter, while the percentage of cream was as high as 16.

No. 1 in the competition is a very profitable cow for the owner, while milk is bought at a fixed price per gallon with no reference to the percentage of butter-fat, but it is an unprofitable one for the factory, and the owner of such a cow simply draws dividends at the expense of the owners of such cows as Nos. 10, 14, 8, and 3.

The results of No. 7 would suggest either that some rain had got into the milk pail, or that the cow was fit for the butcher rather than the milking yard. Ten gallons of milk from this animal would return the butter factory more than 1½ lb. of butter less than the same quantity from No. 10, and the

* During the Berry show 39 samples of milk from the same number of suppliers were tested at the local factory by the Butyrometer—an improved form of Laval's Lactocrite. The butter percentages ranged from 1·2, 1·4, 2, 2·6, 2·8, 3, 3·2, 3·4 up to 5 per cent. Assuming that the samples were fairly and judiciously taken, and that the machine was properly handled, these figures furnish some food for serious reflection.

milk of the former might therefore justly be valued at 2d. a gallon less than that of the latter, when butter is worth 1s. a pound.

In fact the results of these experiments show that Nos. 1, 2, 7, and 9, are very unprofitable cows for the factory; Nos. 3, 6, 8, 10, 13, and 14 are very profitable, while Nos. 4, 5, 11, and 12 attain a fair average.

The best cows are not always the heaviest milkers, but their product in comparison with others may be worth 1d. per gallon more than the average, and even 2d. per gallon more than the worst, for butter making purposes.

Why, then, should not our suppliers be paid according to results, each getting the exact return of butter produced from the milk of his herd, and no dairyman being allowed to supply the factory when his percentage continuously falls below 3·4?

The adoption of this scheme will keep our dairying industry steadily improving, and make our most intelligent dairymen continue to aim at the high standard they have always kept in view. It will render justice to all alike, and it will probably raise the moral tone of the districts into which it is introduced.

This test also points out a matter which is deserving of consideration from those who imagine that such machines as the Victoria tester, which merely indicates the percentage of cream, are reliable tests for determining the butter value of different samples of milk. It will be noticed that one sample which gave 5 3 per cent. of butter-fat showed 16 per cent. of cream, while another sample, showing the same percentage of cream, only yielded 5 per cent. of butter. Two other samples, which indicated the same richness in cream—13 per cent., showed a difference of 1 per cent. of butter-fat, equivalent to 1 lb. of butter to each 10 gallons of milk.

The sooner that our factory managers are convinced that the cream test is of no service in accurately determining the value for butter, the better it will be for the interests of the shareholders and suppliers alike.

As it has been found that a test of each morning's and evening's supply of milk, of say, 100 suppliers, entails an immense deal of work, it has been found practicable to take a week's sample, and thus have the tests conducted once a week. The whole of any one man's supply is turned into a receiving can and thereby thoroughly mixed. It is then weighed, and the weight recorded. It is then allowed to flow downwards into a receiving vat. Half way down the tin tube, leading into this vat, is a small hole under which a jar is set, and as the milk runs over that hole, enough runs into the jar to make a sample. As soon as the whole of the milk has run down, the jar is lifted and the sample taken.

In the Babcock tester the amount needed for each test is 17·6 cubic centimetres of milk.

If it is intended to make the test for three days, a pipette can be made which will take exactly one-third of this amount each day. If the test is to be taken once a week, one-seventh will be taken each day by means of a pipette, which holds one-seventh of the test amount—17 cubic centimetres. It is put day by day into a bottle labelled with the supplier's name.

Although the milk naturally goes sour by the end of the week, it can be made liquid again by the use of soda lye, and the sulphuric acid used in the Babcock tester, with the centrifugal force applied, will soon separate the fat and make it rise to the surface in the neck of the bottle, where it can be read by degrees.

In three States in America there are already 260 creameries using this system, and they have expressed complete satisfaction with the accuracy of the Babcock test. There are in Victoria several of the best factories now

using this cheap and effective machine. In New South Wales we have adopted it at Dapto, and several other factories are preparing to bring it into use.

We hope to see the system universally employed throughout the whole of the milk and cheese factories in New South Wales during the ensuing year.

BABCOCK TEST MILK VALUES.

				Mean Standard			
Per cent. butter fat	3·0	3·2	3·4	3·6	3·8	4·0	5·0
Equivalent in butter from 10 gallons of milk	3·27 lb.	3 54 lb.	3·77 lb.	3·98 lb.	4·22 lb.	4·44 lb.	5·66 lb.
Lb. of milk to 1 lb. butter ...	30·5	28·2	26 5	25·0	23·7	22·5	18·0
Value per gallon in pence ...	$2\frac{7}{16}$	$2\frac{5}{8}$	$2\frac{13}{16}$	3	$3\frac{3}{16}$	$3\frac{5}{16}$	$4\frac{1}{16}$
	$2\frac{5}{8}$	$2\frac{14}{16}$	$3\frac{1}{16}$	$3\frac{1}{4}$	$3\frac{7}{16}$	$3\frac{5}{8}$	$4\frac{7}{16}$
	$2\frac{7}{8}$	$3\frac{1}{8}$	$3\frac{5}{16}$	$3\frac{1}{2}$	$3\frac{11}{16}$	$3\frac{7}{8}$	$4\frac{13}{16}$
	$3\frac{1}{16}$	$3\frac{5}{16}$	$3\frac{9}{16}$	$3\frac{3}{4}$	$3\frac{15}{16}$	$4\frac{3}{16}$	$5\frac{3}{16}$
	$3\frac{1}{4}$	$3\frac{9}{16}$	$3\frac{3}{4}$	4	$4\frac{3}{16}$	$4\frac{7}{16}$	$5\frac{9}{16}$
	$3\frac{1}{2}$	3	4	$4\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{3}{4}$	$5\frac{7}{8}$
	$3\frac{11}{16}$	4	$4\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{3}{4}$	5	$6\frac{1}{4}$
	$3\frac{7}{8}$	$4\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{3}{4}$	5	$5\frac{1}{4}$	$6\frac{5}{8}$
	$4\frac{1}{8}$	$4\frac{1}{2}$	$4\frac{3}{4}$	5	$5\frac{1}{4}$	$5\frac{9}{16}$	7
	$4\frac{5}{16}$	$4\frac{11}{16}$	$4\frac{15}{16}$	$5\frac{1}{4}$	$5\frac{9}{16}$	$5\frac{13}{16}$	$7\frac{5}{16}$
	$4\frac{1}{2}$	$4\frac{7}{8}$	$5\frac{3}{16}$	$5\frac{1}{2}$	$5\frac{13}{16}$	$6\frac{1}{8}$	$7\frac{11}{16}$
	$4\frac{11}{16}$	$5\frac{1}{16}$	$5\frac{7}{16}$	$5\frac{3}{4}$	$6\frac{1}{8}$	$6\frac{3}{8}$	$8\frac{1}{16}$
	$4\frac{15}{16}$	$5\frac{5}{16}$	$5\frac{5}{8}$	6	$6\frac{5}{16}$	$6\frac{5}{8}$	$8\frac{7}{16}$

This table shows the relative values of samples of milk with different percentages of butter fat, ranging from 3 to 5 per cent. For example, when the factory is paying 3d. per gallon for standard milk (3·6 per cent. butter fat), it ought to pay $2\frac{7}{16}$d. for the 3 per cent. milk and $3\frac{5}{16}$d. per gallon for the 4 per cent. milk. When, owing to the rise in the price of butter, the factory may be giving 5d. per gallon for standard milk, the respective prices for 3 per cent. and 4 per cent. milk should be $4\frac{1}{8}$d. and $5\frac{9}{16}$d. per gallon.

In common practice it may not be found necessary to calculate to such small fractions. If it be found expedient to be so minute, some of our factory directors may find it as necessary to improve the breed of their factory and creamery managers as the farmers will to improve the butter-producing character of their dairy herds.

But if this system be too troublesome, why not pay each supplier every week the market rate for the actual amount of butter supplied by him? Suppose that farmer A supplies—Monday, 40 gallons of milk showing 3·8 per cent. butter fat; Tuesday, 50 gallons at 3·6 per cent.; Wednesday, 60 gallons at 3·5 per cent.; Thursday, 40 gallons at 4·2 per cent.; Friday, 50 gallons at 3·8 per cent.; Saturday, 60 gallons at 3·6 per cent.; Sunday, 40 gallons at 4·2 per cent.; he has supplied on the seven days of the week, respectively, 15·2, 18, 21, 16·8, 19, 21·6, 16·8 lb., being a total of 128·4 lb. of butter-fat, which would give at least 143 lb. marketable butter. Why not pay farmer A and each of the other suppliers the market butter price for the actual yield of butter-fat, keeping the 11 or 12 per cent. gained in salting and working the butter, together with the skim milk, for working expenses, and to pay a *pro rata* dividend to suppliers at the end of the year?

Experiments with Babcock's Milk-tester.

F. M'CAFFREY; F. B. GUTHRIE.

WITH the object of testing the efficiency of the Babcock milk-tester, the following series of experiments have been conducted by us.

In the first place, it was sought to ascertain whether the instrument could be relied upon to give the same results under the same conditions. Two samples of milk were taken, eight charges of each milk being introduced into the bottles, and treated according to the directions given.

The following results were obtained:—

	Sample A.		Sample B.
No. 1	3·4 per cent. fat.	No. 1	3·6 per cent. fat.
2	3·4 ,,	2	3·6 ,,
3	3·4 ,,	3	3·6 ,,
4	3·4 ,,	4	3·6 ,,
5	3·4 ,,	5	3·4 ,,
6	3·4 ,,	6	3·6 ,,
7	3·4 ,,	7	3·4 ,,
8	3·4 ,,	8	3·5 ,,
Average	3·4	Average	3·54

To ascertain, in the next place, whether the percentage of fat obtained by the Babcock agreed with the results obtained by the recognised methods, six further samples of milk were treated in duplicate in the machine, and also by drying and extracting with ether, according to the method adopted by the Association of Official Agricultural Chemists, Washington.

The following table shows the result of this comparison:—

	Babcock.				Ether.
A.	No. 1	3·5	Mean ...	3·45	3·22
	No. 2	3·4			
B.	No. 1	3·4	Mean ...	3·4	3·21
	No. 2	3·4			
C.	No. 1	2·6	Mean ...	2·7	2·61
	No. 2	2·8			
D.	No. 1	4·4	Mean ...	4·5	3·85
	No. 2	4·6			
E.	No. 1	3·5	Mean ...	3·5	3·25
	No. 2	3·5			
F.	No. 1	3·7	Mean ...	3·65	3·31
	No. 2	3·6			

From the above it will be seen that the results were in all cases somewhat higher than those obtained by extraction. They are, however, strictly comparable, and, with the exception of D, do not vary from them by more than ½ per cent.

A further test of the efficiency of the machine was made by diluting the first four of the above samples with an equal volume of water, the diluted milk being treated in duplicate by the machine.

Here, again, the differences observed were within ½ per cent.

		Diluted with equal bulk of water.			Theoretical yield calculated from the previous experiment.
A.	No. 1	1·8	Mean ...	1·8	1·72
	No. 2	1·8			
B.	No. 1	1·8	Mean ...	1·8	1·70
	No. 2	1·8			
C.	No. 1	1·6	Mean ...	1·6	1·35
	No. 2	1·6			
D.	No. 1	2·4	Mean ...	2·45	2·25
	No. 2	2·5			

It was next sought to ascertain whether the prolonged contact of the acid with the butter fat had any appreciable effect upon the reading. With this object, the two samples used in the first experiment were taken. Eight charges of each were filled, the acid run in, and the bottles allowed to stand for forty-five minutes. They were then placed in the centrifugal machine, and whirled simultaneously with other charges, and the same milks mixed with acid immediately beforehand. Those bottles which had been allowed to stand had cooled down considerably, but no hot water was added to the tank during whirling.

		Mixed with acid immediately beforehand.	Allowed to stand forty-five minutes in contact with acid.
A.	No. 1	3·4	3·6
	2	3·4	3·6
	3	3·4	3·6
	4	3·4	3·5
	5	3·4	3·5
	6	3·4	3·5
	7	3·4	3·6
	8	3·4	3·6
	Mean	3·4	3·56
B.	No. 1	3·6	3·6
	2	3·6	......
	3	3·6	......
	4	3·6	3·6
	5	3·4	3·5
	6	3·6	3·6
	7	3·4	3·5
	8	3·5	3·6
	Mean	3·54	3·57

These results, though not greatly divergent, were unsatisfactory, as there was often considerable difficulty in obtaining a proper reading in these samples left in contact with the acid. Nos. 2 and 3 of milk B were quite obscured, and the rest to a lesser degree, by the presence of charred matter in the fat layer, the edges of which were indistinct. The presence of this char also, no doubt increased the length of the column of fat, giving too high a reading. As this may have been due either to the action of the acid on the fat or to the fact that the temperature during whirling was insufficient, three additional samples were obtained, charged in duplicate with acid as before, and were allowed to stand for one and a half hours. In this case the bottles had become quite cold. They were then whirled together with check charges mixed immediately before whirling, the tank being filled with hot water

(75° Cent.) during the process. The following table shows the results of this experiment :—

		Mixed immediately beforehand.	Standing for 1½ hours in contact with acid.
A	No. 1 ...	3·0	3·0
	No. 2 ...	3·0	3·0
B	No. 1 ...	3·0	3·0
	No. 2 ...	3·0	3·0
C	No. 1 ...	3·0	3·0
	No. 2 ...	3·0	3·0

With reference to the above numbers it must be stated that the above samples were of one and the same milk, a fact of which one of us (the one who took the readings) was unaware until afterwards.

In all these readings the layer of fat was clear, well defined, and quite free from char. From the above experiments, carried out with all possible care, we consider ourselves justified in drawing the following conclusions :—

1. The Babcock machine may be relied on to give uniform and concordant results within a limit of one-fifth per cent.

2. Its results do not differ from those obtained by extraction with ether by more than one-fifth per cent.

3. The prolonged contact of the acid with the milk in the bottle before whirling has no effect upon the reading of the butter fat within the limits of time occupied by the test. Should the acid have remained for any great length of time in contact with the milk, the tank must be filled with hot water. In any case, we consider the readings are more reliable if hot water be added during whirling, but if the filling be done expeditiously, and the bottles rotated at once, the initial temperature is sufficient.

4. Scrupulous attention to the detailed instructions is absolutely essential, as are also strict cleanliness and accuracy.

5. The machine is sound in principle and easy to understand and to work.

6. The time required for the treatment of twenty-four samples is about one and a half hours from the filling of the first bottle to the reading of the last. Forty-eight samples may be done in two hours if two men are working. We, would, however, always advise that each milk be tested in duplicate. Thus fifty samples could be treated in about three hours.

7. The cost of the acid used for charging twenty-four bottles is about 3d. Commercial sulphuric acid may be used, but it is important that it should be of the right strength. Its specific gravity should not be much more nor less than 1·834.

8. It has the great advantage over gravimetric methods that it is more expeditious, and does not require any special skill in the manipulation; accuracy and cleanliness are absolutely essential. It should, in our opinion, prove of great use in butter factories. With a ready and effective means of testing the quality of the milk supplied, both buyers and sellers would be benefited, as a fair scale of payment, according to the richness of the milk, could be adopted.

The Department will undertake to test the accuracy of the pipettes and flasks supplied to purchasers of these machines, as everything depends upon their accuracy.

NOTE.—In connection with the above articles, it is interesting to note that according to Prof. Henry of the Agricultural Experiment Station, attached to the University of Wisconsin, "the Babcock test was invented by Dr. Babcock of this station, and given to the people without patent. It is used by several thousand creameries and cheese factories which pay for the milk by the fat delivered, and on thousands of farms for testing the cows and weeding out the poor ones. It is revolutionizing American Agriculture."

Analyses of Soils.

By F. B. GUTHRIE,
Departmental Analyst.

(With notes by the Director of Agriculture.)

Native Dog Bore.

A proposal has been made to utilise the water from some of the artesian bores in the Colony for irrigation purposes. The reserve in connection with the Native Dog artesian bore, about 45 miles from the town of Bourke on the Barrigun Road, has been indicated as one that will be likely to give excellent commercial results if it be found that suitable crops can be grown with the aid of the large flow of water now running to waste from this bore. The quality of the water from the different bores has been investigated by Mr. J. C. Mingaye, analyst to the Department of Mines, who has found in most cases that the water is suitable in character. It should perhaps be mentioned that the suitability of artesian water is not invariably demonstrated by the fact that it contains an apparently small percentage of injurious matter in solution. A great deal depends upon the mechanical nature of the soil—whether it is such as will permit the injurious matter to pass through it or retain a large part of it, as in a filter-bed, gradually accumulating until it attains a percentage likely to injure vegetable life. Where large quantities of water are allowed to collect and evaporate on the surface of a retentive soil, any saline matter held in solution must inevitably be deposited, and where the soil is of a very fine character, it is found that the water in descending to the subsoil invariably leaves behind more or less of the salts held in solution filtered out in the surface soil. The experience gained by some investigations into the water and soil of the Native Dog bore would indicate the need for caution in experimenting with artesian water containing any injurious salts, such as this is found to do.

Acting on the instructions of the Minister, Mr. John Coleman, of the Department, inspected the Native Dog reserve. His report is to the effect that the estimated supply from the bore is 2,000,000 gallons per day, and that there is a large supply now running to waste, which, if suitable, could, with great advantage, be utilized for irrigation purposes. In this event about 1,000 to 1,280 acres of land could easily be irrigated—say for lucerne, with the water from the bore. As to the necessity for irrigation, he mentions that the registered rainfall of the district for the last five years has averaged only 17 inches. The water as it comes from the bore has a temperature of

92 degrees Fahr., when it has a strong taste of soda, but this taste greatly decreases when the water is cool. The caretaker and his family have used it for some months for all purposes without ill effects.

The report includes the following analysis of the water made by Mr. J. C. Mingaye, F.C.S.:—

Water from Native Dog bore; depth, 475 feet; temperature, 92 degrees Fahr.

	Grains, per gallon.	Parts, per 1,000.
Total solid residue	45·108	0·6444
Soluble saline matter	44·044	0 6292
Insoluble mineral matter	1·064	0.0152
Chlorine	4,500	0·0642
Equal to chloride of sodium	7·415	0·1059

The water was clear and colourless and free from odour. On evaporation gave a strong alkaline reaction; before evaporation slight alkaline reaction. The soluble saline matter consists chiefly of alkaline carbonates, chloride of sodium (common salt), silica, and strong traces of lime, magnesia, and sulphuric acid. The quantities of both samples received were rather small for analysis. The alkaline carbonates, where present in large quantity, are known to excite a strong corrosive action upon the roots or the plants, their action being to a great extent remedied by the addition of gypsum to the soil. The amount present in these waters, however, is small, and they may be classed as of a good description for irrigation purposes, and suitable for all domestic purposes."

Mr. Coleman concludes by explaining that there would be a good market available should an irrigation area be successfully conducted at this bore. He also describes the character of the land surrounding the bore, and gives some useful information with regard to the cost of clearing, fencing, &c., and recommends that the caretaker should be supplied with seeds for cultivation on an experimental scale.*

Mr. J. Low, chief inspector of water conservation, who accompanied Mr. Coleman on his visit to the bore, expresses it as his opinion, that the flow of water does not exceed half a million gallons. He strongly recommends that the caretakers of the bores should, when possible, carry out the experimental work suggested.

The following analyses have been made by Mr. Guthrie, of four samples of soil from the Native Dog Bore.

No. 1.

A SAMPLE of soil from Native Dog Bore Reserve has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The geological formation of the surrounding country is tertiary; the nature of the soil is sandy; the nature of the subsoil, similar to surface soil; the reaction of the soil is neutral; and its capacity for water, 22·2 per cent. Absolute weight per acre, 6 inches deep, 3,418,316 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·0 per cent.; stones over ¼ inch in diameter, ·0 per cent.; coarse gravel, more than $\frac{1}{10}$ inch diameter, ·0 per cent.; fine gravel, more than, $\frac{1}{50}$ inch

* Such experiments will have to be carried out for several years before it will be safe to make any general deductions as to the effects of heavy waterings of this artesian water on the soils in close proximity to the bore. There can be no doubt that any of the soils will give good results with the aid of water for a few years, but, in the case of three out of the four samples examined, the low percentage of phosphoric acid will make itself apparent in the gradually diminishing yields of grain crops. For these inferior soils lucerne will probably be found the most suitable crop.

diameter, 6·43 per cent.; fine soil, 93·57 per cent., comprising sand, 89·43 per cent., and impalpable matter, chiefly clay, 4·14 per cent.

An analysis of the fine soil discloses moisture, 1·166 per cent., and volatile and combustible matter, principally organic, 1·796 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consists of: Lime (CaO), ·183 per cent., the general value of which is satisfactory, being equivalent to 6,222 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·086 per cent., the general value of which is fair, being equivalent to 2,924 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·039 per cent., the general value of which is indifferent, being equivalent to 1,326 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·091 per cent. (equal to ·111 per cent. of ammonia), the general value of which is fair, being equivalent to 3,094 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·107 per cent., general value of which is satisfactory; ferric oxide (Fe_2O_3), 2·639 per cent., general value satisfactory; and sulphuric acid (SO_3), ·033 per cent., general value satisfactory; ferrous oxide, 1·447 per cent., general value excessive.

In connection with the foregoing particulars, the special points of value in the soil are none; its special defect, phosphoric acid; its general character mechanically is good, and chemically tolerable. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district are fruit and lucerne, if water be supplied; while it is unsuitable, without manure or special treatment, for heavy continuous crops of hay, maize, and cereals. Intense cultivation by means of artificial watering will soon exhaust the comparatively small stores of phosphoric acid and organic matter. If available, bone-dust would be the best manure.*

Speaking generally, this soil is the worst of the four samples from this reserve, and the difference between this one and the best, No. 3, is very striking. Fallowing and exposing to the air will turn the deleterious black oxide of iron into red oxide of iron. Green manuring with cowpeas, peas, vetches, and clover, would improve the texture of the soil, and increase its supplies of nitrogen. Bone-dust or bone-dust and dried blood would be of great value.

No. 2.

A SECOND sample from Native Dog Bore Reserve has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The geological formation of the surrounding country is tertiary; the nature of the soil is light sandy loam; the nature of the subsoil, similar to top soil; the reaction of the soil is neutral; and its capacity for water, 22·8 per cent. Absolute weight per acre, 6 inches deep, 3,326,481 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·00 per cent.; stones over ½ inch in diameter, ·00 per cent.; coarse gravel,

NOTE.—(*a*) This amount of lime would be supplied in 6,913 lb. of quicklime, or 9,333 lb. of slaked lime, or 12,444 lb. chalk. (*b*) This amount of potash would be supplied in 5,848 lb. of commercial sulphate of potash or 24,356 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 5,304 lb. of commercial bone-dust, or 7,956 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 15,470 lb. of sulphate of ammonia, or 18,564 lb. of nitrate of soda.

*The boiling-down works at Bourke will shortly have an excellent bone-dust and dried blood on sale, at a very cheap rate. It is to be hoped that the Western pastoralists and farmers will not allow these valuable constituents from their soils to be sent away to New Zealand, to be used to grow turnips for feeding the cross-bred sheep which are bringing top prices in the English market.

more than $\frac{1}{10}$ inch diameter, ·00 per cent.; fine gravel, more than $\frac{1}{50}$ inch diameter, 7·00 per cent.; fine soil, 93 per cent., comprising sand, 78·47 per cent., and impalpable matter, chiefly clay, 14·53 per cent.

An analysis of the fine soil discloses moisture, 2·470 per cent., and volatile and combustible matter, principally organic, 2·868 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·190 per cent., the general value of which is satisfactory, being equivalent to 6,270 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·136 per cent., the general value of which is satisfactory, being equivalent to 4,488 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·038 per cent., the general value of which is indifferent, being equivalent to 1,254 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·112 per cent. (equal to ·136 per cent. of ammonia), the general value of which is satisfactory, being equivalent to 3,696 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·066 per cent. general value of which is indifferent; ferric oxide (Fe_2O_3), 2·741 per cent.; general value, satisfactory; and sulphuric acid (SO_3), ·040 per cent., general value, satisfactory; ferrous oxide, ·217 per cent.

In connection with the foregoing particulars, the special point of value in the soil is potash; its special defects, phosphoric acid and organic matter; its general character mechanically is good, and chemically not evenly balanced. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are fruit and lucerne, with the aid of good water; while it is unsuitable, without special manure or special treatment, for cereals. The manures and treatment recommended for trial: Irrigation will probably in a few years exhaust the rather small stores of phosphoric acid and nitrogenous matter. Moderate dressing of bone-dust would be very serviceable, if available at moderate cost.

Speaking generally, with artificial watering, this soil should give very satisfactory results for a few crops, but the low percentage of phosphates would in time cause disappointment, unless steps be taken to renew the supplies of phosphoric acid removed in crops, by means of moderate dressings of good bone-dust.

No. 3.

A THIRD sample from Native Dog Bore Reserve has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The geological formation of the surrounding country is tertiary; the nature of the soil is sandy; the nature of the subsoil, similar to top soil; the reaction of the soil is neutral; and its capacity for water, 22·2 per cent. Absolute weight per acre, 6 inches deep, 3,418,316 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·0 per cent.; stones over $\frac{1}{4}$ inch in diameter, ·0 per cent.; coarse gravel, more than $\frac{1}{10}$ inch diameter, ·0 per cent.; fine gravel, more than $\frac{1}{50}$ inch diameter, 7·2 per cent.; fine soil, 92·8 per cent., comprising sand, 87·95 per cent., and impalpable matter, chiefly clay, 4·85 per cent.

NOTE.—(*a*) This amount of lime would be supplied in 6,966 lb. of quicklime, or 9,405 lb. of slaked lime, or 12,540 lb. of chalk. (*b*) This amount of potash would be supplied in 8,976 lb. of commercial sulphate of potash, or 37,385 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 5,016 lb. of commercial bone-dust, or 7,524 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 18,480 lb. of sulphate of ammonia, or 22,176 lb. of nitrate of soda.

An analysis of the fine soil discloses moisture, 1·259 per cent., and volatile and combustible matter, principally organic, 2·487 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·141 per cent., the general value of which is satisfactory, being equivalent to 4,794 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·144 per cent., the general value of which is satisfactory, being equivalent to 4,896 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·119 per cent., the general value of which is satisfactory, being equivalent to 4,046 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·104 per cent. (equal to ·127 per cent. of ammonia), the general value of which is satisfactory, being equivalent to 3,536 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·051, general value of which is indifferent; ferric oxide (Fe_2O_3), 2·030 per cent., general value satisfactory; and sulphuric acid (SO_3), ·043 per cent., general value satisfactory. Ferrous oxide, ·224 per cent.

In connection with the foregoing particulars, the special point of value in the soil is potash; its special defect, deficiency of organic matter; its general character mechanically is very good, and chemically good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district are any crops suited to the climatic conditions. The manures and treatment recommended for trial: With suitable water this soil ought to yield good crops for some years. Green manuring with leguminous crops would improve the soil and increase its store of organic matter. Nitrogenous manures, such as dried blood, would probably pay.

Speaking generally, this soil is much richer and more evenly balanced than the other three from the same reserve. It should give good results with fruit, vines, lucerne, maize, sorghum, vegetables and grass, with intense cultivation by means of watering.

No. 4.

A FOURTH sample from Native Dog Bore Reserve has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The geological formation of the surrounding country is tertiary; the nature of the soil is sandy; the reaction of the soil is alkaline (strongly); and its capacity for water 20 per cent. Absolute weight per acre, 6 inches deep, 2,959,139 lb.

A mechanical analysis of this soil shows that it contains of root fibres ·0 per cent.; stones over $\frac{1}{4}$ inch in diameter, ·0 per cent.; coarse gravel, more than $\frac{1}{10}$ inch diameter, ·0 per cent.; fine gravel, more than $\frac{1}{50}$ inch diameter, 8·68 per cent.; fine soil, 91·32 per cent., comprising sand, 88·56 per cent., and impalpable matter, chiefly clay, 2·76 per cent.

An analysis of the fine soil discloses moisture, 7·359 per cent., and volatile and combustible matter, principally organic, 6·056 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·195 per cent., the general value of which is

NOTE.—(*a*) This amount of lime would be supplied in 5,326 lb. of quicklime, or 7,191 lb. of slaked lime, or 9,588 lb. of chalk. (*b*) This amount of potash would be supplied in 9,792 lb. of commercial sulphate of potash, or 40,783 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 16,184 lb. of commercial bone-dust, or 24,276 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 17,680 lb. of sulphate of ammonia, or 21,216 lb. of nitrate of soda.

satisfactory, being equivalent to 5,655 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·018 per cent., the general value of which is indifferent, being equivalent to 1,392 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·069 per cent., the general value of which is fair, being equivalent to 2,001 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·069 per cent. (equal to ·085 per cent. of ammonia), the general value of which is fair, being equivalent to 2,001 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·113 per cent., general value of which is satisfactory; ferric oxide (Fe_2O_3), 1·624 per cent.; general value satisfactory; and sulphuric acid (SO_3), ·059 per cent.; general value, satisfactory; ferrous oxide, ·434 per cent.

In connection with the foregoing particulars, the special point of value in the soil is its mechanical condition; its special defects are a deficiency of potash, and an excess of alkaline carbonates deleterious to most forms of vegetation. Its general character mechanically is very good, and chemically indifferent. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are none, till the carbonate of soda shall have been neutralised or washed out of the soil. The manures and treatment recommended for trial: Without irrigation no crops are likely to thrive; with irrigation, drainage, or treatment with gypsum (sulphate of lime), would be necessary in order to get the soluble alkaline carbonate of soda washed out of the soil or neutralised. Intense cultivation by means of watering would, probably, soon reduce the stores of potash, phosphoric acid, and nitrogenous matter below the remunerative point.

Speaking generally, the high percentage of carbonate of soda suggests the idea that a large quantity of water from the bore has been allowed to lie on the surface of the soil till it evaporated and left this saline deposit. It indicates the need of caution in applying large quantities of the water for continuous periods.

Remarking on the results of these analyses, Mr. Guthrie says:—"Sample No. 4 of the soils from the Native Dog Bore was mixed with a deposit consisting principally of sodium carbonate and chlorides. The sodium carbonate amounted to 6·22 per cent. of the entire soil. An analysis of the artesian water bore at Native Dog is given in Mr. Boultbee's report on artesian boring. In this report Mr. Mingaye describes the water as of a good description for irrigation purposes. In the case of the sample of soil the water had no doubt dried up and left the deposit. I have no hesitation in saying that this soil was unfit for growing crops, sodium carbonate having a corrosive action on the roots. It might be worth while to estimate the percentage of carbonate present in the water, which Mr. Mingaye says is small. Mr. Mingaye also finds strong traces of lime, magnesia, and sulphuric acid, which, however, have not increased the percentages of these substances in the sample of soil to any appreciable extent."

In his minute on the results of these analyses, the Director says:—"The analyses of the four soils submitted to the chemist show disappointing results, as only one is a good soil. The other three are weak in the most important constituent—phosphoric acid—and would not stand the

NOTE.—(*a*) This amount of lime would be supplied in 6,283 lb. of quicklime, or 8,482 lb. of slaked lime, or 11,310 lb. of chalk. (*b*) This amount of potash would be supplied in 2,784 lb. of commercial sulphate of potash, or 11,595 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 8,004 lb. of commercial bone-dust, or 12,006 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 10,005 lb. of sulphate of ammonia, or 12,006 lb. of nitrate of soda.

drain of intense cultivation for more than a few years. With cheap bone-dust and dried blood available at Bourke, profitable manuring will be practicable when the soils, after a few heavy crops, begin to show signs of partial exhaustion. Soil No. 4 shows the deleterious nature of the water issuing from the bore. It has been soaked with the water for some time, and has evidently filtered the alkaline carbonates out of the water till it has become charged to the extent of 6 per cent., an amount fatal to most vegetable growth. It would therefore be unwise to do more at present than to conduct a small experiment with lucerne, maize, wheat, sorghum, roots, and grasses to find whether the land, when under proper cultivation and treated with limited quantities of the bore water, will gradually become so impregnated with the deleterious ingredients of the water as to be useless for plant growth."

With regard to the sample No. 4 it may be remarked that the presence of sodium carbonate in the soil to the extent here observed is undoubtedly harmful; in fact, in clay soils $\frac{1}{10}$ per cent. of this salt has been found to render the ground untillable.

In a sandy soil, however, such as the one under consideration, this objectionable quality is less marked, and there is no doubt that within certain limits the presence of a small proportion of alkali is distinctly beneficial.

This is due chiefly to the fact that the soil is directly enriched, owing to the property possessed by sodium carbonate of disintegrating the soil and thus increasing the supply of soluble plant food. Notably is this the case with phosphate of iron which is dissolved by sodium carbonate and presented to the plant in a form in which it can at once be availed of.

The process of nitrification is further greatly favoured by alkalinity.

Against these advantages, which it possesses when present in small quantities, must be set off the damage done by it when present in excess.

It dissolves the humus substances, among the most important of the soil ingredients, and it is quite possible that the whole of the humus may be dissolved out and washed away through the soil.

It attacks the roots of the plants, corroding and dissolving the bark, and ultimately the wood.

It renders tillage operations difficult and often impossible. Carbonate of soda, when mixed with clay, forms an exceedingly tenacious mass, and the effect of continued ploughing is to leave the land in hard lumps.

Professor Hilgard, of the Californian University, has devoted many years to the study of this question, and we are indebted to him for most of the information obtainable upon this subject.

The reclamation of what are known as "alkali soils" is a question of great importance in California, where large tracts of country are waste from lack of water, plant food being often abundant.

In many cases an accumulation of salt has taken place on the surface, especially during dry weather following upon rains or irrigation. These salts consist mainly of chloride, sulphate, and carbonate of soda. It is the presence of this last salt that renders the deposit alkaline.

The accumulation is brought about by the rising of the soil-water, charged with these salts, through the soil, and its rapid evaporation upon reaching the surface.

The remedies recommended by Professor Hilgard as the result of his investigations are the following:—

1. Tillage, to prevent too rapid evaporation.
2. Drainage, to wash out and remove the salts.
3. Chemical correctives.

Simple irrigation is, as a rule, ineffective, unless accompanied by under-drainage, as the salts are simply washed deeper into the soil, and continually rise again by capillarity as the surface moisture evaporates. This, at least, is Professor Hilgard's experience with the clay soils of California. The fact, however, is to be noted that in the case of sandy soils, although the initial rise of water is more rapid than in the clay soils, the limit beyond which it ceases to rise is sooner reached. In other words, a solution of alkali will rise more quickly in a sandy soil than in a clay one, but it will not rise so high.

It is, therefore, possible that in the case of the soil we are considering a thorough leaching out with water would be sufficient to remove the alkali entirely, for if it were once washed a few feet below the surface it would in all probability not be able to rise again to the surface, and would form a deposit below the reach of plant roots.

Of chemical correctives, gypsum (sulphate of lime) is found to be the most efficacious. This substance, in the presence of moisture, readily neutralises the alkali, forming carbonate of lime and sulphate of soda, two salts which are uninjurious to plant life.

The gypsum is sown or spread on the surface, and ploughed in to a moderate depth just before irrigation or rainfall. The amount required depends on the amount of alkali present, as determined by analysis.

Professor Hilgard further recommends, as suitable crops for alkali soils, such crops as lucerne, which prevent surface evaporation by shading the ground, and, moreover, cause almost the entire evaporation to pass up from its roots through its leaves, so as not to reach the surface at all.

He further recommends beets, fruit, and sorghum as profitable crops, cereals being the least likely of any crops to do well.

URALLA.

A SAMPLE of soil from proposed experimental farm site, Uralla, has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department.

The nature of the soil is sandy loam; the reaction of the soil is neutral; and its capacity for water, 40·66 per cent. Absolute weight per acre, 6 inches deep, 2,428,535 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·20 per cent.; stones over ¼ inch in diameter, nil; coarse gravel, more than $\frac{1}{10}$ inch diameter, nil; fine gravel, more than $\frac{1}{50}$ inch diameter, 5·52 per cent.; fine soil, 94·28 per cent., comprising sand, 60·70 per cent., and impalpable matter, chiefly clay, 33·58 per cent.

An analysis of the fine soil discloses moisture 1·315 per cent., and volatile and combustible matter, principally organic, 4·364 per cent.

The fertilizing substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·194 per cent., the general value of which is satisfactory, being equivalent to 4,656 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·229 per cent., the general value of which is satisfactory, being equivalent to 5,496 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·070 per cent., the general value of which is fair, being equivalent to 1,680 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·106 per cent. (equal to ·129 per cent. of ammonia), the general value of which is satisfactory, being equivalent to 2,544 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·317 per cent., general value of which is satisfactory; ferric oxide (Fe_2O_3), ·981 per cent., general value deficient; ferrous oxide, ·576 per cent.; and sulphuric acid (SO_3), ·047 per cent., general value, satisfactory.

In connection with the foregoing particulars, the special points of value in the soil are potash and mechanical condition; its special defect, phosphate of lime and organic matter; its general character mechanically is good, and chemically tolerably satisfactory. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district are fruit, potatoes, and lucerne, while it is unsuitable, without special manure or special treatment, for cereals, turnips, grass. The manures and treatment recommended for trial are: bone-dust and dried blood 4 cwt. per acre, or Sugar Company's No. 2 manure, 3 to 4 cwt. per acre. Sow with peas, tares, and clover, and plough in before sowing wheat or maize.

Speaking generally, as much green matter as possible should be ploughed into this land, and it should be dressed regularly with good bone-dust for general crops; Sugar Company's No. 2 for turnips or spring crops.

Glen Innes.

A sample of soil from Government Reserve, Glen Innes, has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is loam; the reaction of the soil is neutral; and its capacity for water, 38·66 per cent. Absolute weight per acre, 6 inches deep, 2,703,987 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·20 per cent.; stones over ¼ inch in diameter, 1·35 per cent.; coarse gravel, more than $\frac{1}{10}$ inch diameter, 3·22 per cent.; fine gravel, more than $\frac{1}{50}$ inch diameter, 6·44 per cent.; fine soil, 88·79 per cent., comprising sand, 43·47 per cent., and impalpable matter, chiefly clay, 45·32 per cent.

An analysis of the fine soil discloses moisture, 6·963 per cent., and volatile and combustible matter, principally organic, 8·866 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·407 per cent., the general value of which is

Note.—(*a*) This amount of lime would be supplied in 5,173 lb. of quicklime, or 6,984 lb. of slaked lime, or 9,312 lb. of chalk. (*b*) This amount of potash would be supplied in 10,992 lb. of commercial sulphate of potash, or 45,871 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 6,720 lb. of commercial bone-dust, or 10,080 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 12,720 lb. of sulphate of ammonia, or 15,264 lb. of nitrate of soda.

satisfactory, being equivalent to 10,989 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·102 per cent., the general value of which is satisfactory, being equivalent to 2,754 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·192 per cent., the general value of which is satisfactory, being equivalent to 5,184 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·232 per cent. (equal to ·282 per cent of ammonia), the general value of which is good, being equivalent to 6,264 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·429 per cent., general value of which is satisfactory; ferric oxide (Fe_2O_3), 4·006 per cent., general value satisfactory; ferrous oxide (FeO), 2·592 per cent, excessive; and sulphuric acid (SO_3), ·027 per cent., general value satisfactory.

In connection with the foregoing particulars, the special points of value in the soil are nil, while its special defect is excess of black oxide of iron, which could be turned into the red by good cultivation; its general character mechanically is very fair, and chemically good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are wheat, maize, summer fruit, potatoes, hay, while it is unsuitable, without special manure or special treatment, for none suited to the climate. The manures and treatment recommended for trial are—fallowing, to get rid of the black oxide of iron; liming to decompose the clay, and liberate latent potash. For fruit-trees draining would be very valuable. Experiments might be tried with bone-dust, to see if its use would pay.

Speaking generally, for a few years manuring would not be essential, but it would probably be found to pay after a few good crops. Sugar Company's No. 3 or bone-dust and kainit in equal parts—3 to 4 cwt. per acre, could be recommended for trial.

COBARGO.

A SAMPLE of soil from Cobargo has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is light sandy loam; the reaction of the soil is neutral; and its capacity for water 37·66 per cent. Absolute weight per acre, 6 inches deep, 2,875,467 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·27 per cent.; stones over ½-inch in diameter, nil; coarse gravel, more than $\frac{1}{10}$-inch diameter, 1·62 per cent.; fine gravel, more than $\frac{1}{50}$-inch diameter, 34·27 per cent.; fine soil, 63·84 per cent., comprising sand, 40·20 per cent., and impalpable matter, chiefly clay, 23·64 per cent.

An analysis of the fine soil discloses moisture, 1·728 per cent., and volatile and combustible matter, principally organic, 6·740 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·243 per cent., the general value of which

NOTE.—(*a*) This amount of lime would be supplied in 12,210 lb. of quicklime, or 16,483 lb. of slaked lime, or 21,978 lb. of chalk. (*b*) This amount of potash would be supplied in 5,508 lb. of commercial sulphate of potash, or 22,940 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 20,736 lb. of commercial bone-dust, or 31,104 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 31,320 lb. of sulphate of ammonia, or 37,854 lb. of nitrate of soda.

is satisfactory, being equivalent to 6,804 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·130 per cent, the general value of which is satisfactory, being equivalent to 3,640 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·070 per cent., the general value of which is fair, being equivalent to 1,960 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·162 per cent. (equal to ·197 per cent. of ammonia), the general value of which is satisfactory, being equivalent to 4,536 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·395 per cent., general value of which is satisfactory; ferric oxide (Fe_2O_3), ·214 per cent., general value deficient; ferrous oxide (FeO), ·756, deleterious; and sulphuric acid (SO_3), ·024 per cent.; general value, satisfactory.

In connection with the foregoing particulars, the special point of value in the soil is the mechanical condition, and its special defect, phosphate of lime. Its general character mechanically is good, and chemically, fair. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are fruit, greenstuff, vegetables and roots, while it is unsuitable, without special manure or special treatment, for cereals, heavy crops of grass or hay. The manures and treatment recommended for trial are bone-dust (3 to 4 cwt. per acre), or Sugar Company's No. 2 manure, same amount; for pasture the refuse from boiling-down works, which can be got cheap, would be very useful; for turnips and potatoes, the artificial soluble manure; for maize and green crops, the bone-dust.

Speaking generally, this land should respond well to good treatment, as it is kindly to work. It would probably pay to grow peas, tares, and clover to plough in before putting in maize or roots. Opening up to the air will soon get rid of the deleterious black oxide, making it into the red oxide (rust). Lime, if available cheaply, can be recommended.

CANOBLAS.

A SAMPLE of soil from Canoblas has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is loam; the reaction of the soil is neutral; and its capacity for water, 48·33 per cent. Absolute weight per acre, 6 inches deep, 2,400,632 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·10 per cent.; stones over $\frac{1}{4}$-inch in diameter, nil; coarse gravel, more than $\frac{1}{10}$-inch diameter, 2·64 per cent.; fine gravel, more than $\frac{1}{50}$-inch diameter, 4·37 per cent.; fine soil, 92·89 per cent., comprising sand, 36·20 per cent., and impalpable matter, chiefly clay, 56·69 per cent.

An analysis of the fine soil discloses moisture, 3·753 per cent., and volatile and combustible matter, principally organic, 5·319 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·206 per cent., the general value of which

NOTE.—(*a*) This amount of lime would be supplied in 7,569 lb. of quicklime or 10,206 lb. of slaked lime, or 13,608 lb. of chalk. (*b*) This amount of potash would be supplied in 7,280 lb. of commercial sulphate of potash or 30,321 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 7,840 lb. of commercial bone-dust or 11,760 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 22,680 lb. of sulphate of ammonia or 27,216 lb. of nitrate of soda.

is satisfactory, being equivalent to 4,944 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·130 per cent., the general value of which is satisfactory, being equivalent to 3,120 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·153 per cent., the general value of which is satisfactory, being equivalent to 3,672 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·123 per cent. (equal to ·149 per cent. of ammonia), the general value of which is satisfactory, being equivalent to 2,952 lb. (*d*) in an acre of soil 6 inches deep. There is also magnesia (MgO), ·184 per cent., general value of which is satisfactory; ferric oxide (Fe_2O_3), 4·955 per cent., general value satisfactory; ferrous oxide (FeO), ·936; and sulphuric acid (SO_3), ·022 per cent., general value, satisfactory.

In connection with the foregoing particulars, this soil is very equal, having no special point of value, and no special defect. Its general character mechanically is very fair, and chemically, satisfactory. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are wheat, beans, peas, fruit, grass, while it is unsuitable, without special manure or special treatment, for no crops suited to the district. The manures and treatment recommended for trial are—1. Fallowing, in order to convert the black oxide of iron into the red oxide; 2. Lime in autumn—1 ton per acre; 3. Sulphate of ammonia—1½ cwt. per acre, or dried blood (3 cwt.) in early spring for cereals of all sorts.

Speaking generally, for potatoes it would be well to use 3 cwt. kainit, as well as the dried blood; and for peas, Sugar Company's No. 6 manure (2 to 3 cwt. per acre) without dried blood. Local bone-dust ought to be used in conjunction with dried blood (three to one), which would probably supplement its action.

NOTE.—(*a*) This amount of lime would be supplied in 5,493 lb. of quicklime, or 7,416 lb. of slaked lime, or 9,888 lb. of chalk. (*b*) This amount of potash would be supplied in 6,240 lb. of commercial sulphate of potash, or 25,989 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 14,688 lb. of commercial bone-dust or 22,032 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 14,760 lb. of sulphate of ammonia or 17,712 lb. of nitrate of soda.

Poultry.

BY THE SUB-EDITOR.

TABLE BREEDS.

As intimated in last month's *Gazette*, it is at present necessary to deal separately with layers and table birds, for the simple reason that the breed representing to the full both these qualities has yet to be produced. The only breed which, in my opinion, most nearly reaches the point of perfection is the Plymouth Rock, but on comparing this breed with the Leghorn, I must perforce place it under the head of this article, its table qualities being greater than its laying qualities.

It will, I think, be generally admitted that the essentials of a table-bird are quick maturity, large size, and excess of meat over bone and offal. Further than this, the proportion of white or breast meat is certainly a point for consideration. Before proceeding to detail a few of the breeds which can be confidently recommended for table purposes, I shall take the liberty of again impressing on my readers the fact that hardiness, and consequent early maturity, are more often to be found amongst well-bred stock, and further, that well-bred stock possessing such attributes cost actually less to feed and rear than mongrel birds, the stamnia in which has been allowed to diminish by in-breeding and general neglect. Many of the well-known breeds are noted for hardiness, and the general robust health of the chicks enables them to take their food freely, and assimilate it rapidly, this being the only secret of quick maturity.

I must confess strong bias in favour of the larger breeds for table birds. A miserable rat of a bird on a large dish has anything but an appetising appearance. Taking the quantity and quality of breast meat as a chief essential in a table-bird, I know of no breed which surpasses the game, and therefore claim this breed as the most valuable for that purpose. Moreover, games are notorious for their hardiness, and consequent easiness to rear. I have often heard it remarked that games are "all legs and neck," but the simple holding up of a game in one hand and some other breed in the other will quickly dispel such delusion. Careful inspection of this favourite breed will disclose the fact that the heart-shaped body is the very ideal of a table-bird, and no intelligent person, who has had the pleasure of carving, and partaking of a well-developed eight-month Cockerel, will hesitate to support my opinion. Next on the list comes the Plymouth Rock, which possesses a wealth of white juicy breast meat. This bird is hardy, and matures quickly, and I have it on the authority of a very successful New South Wales breeder that Cockerels of his strain constantly weigh 5 lb. at four months old. I shall place third in the list the English Dorking, and must again express surprise at the limited number of friends this bird has secured in Australia. I England the breeding and feeding for the table of this breed is a staple

industry of the county of Surrey, and especially around the town after which the breed is named. It is possible that breeders fight shy of the Dorking in consequence of a liability to club foot, and to slight delicacy in the chickens. Of course the change of climate will have no effect in preventing club-foot, that is more a matter of housing, and low perches; but I cannot help thinking that the salubrious climate of the greater portion of this country will have a beneficial effect on their constitution.

Next in order come the Asiatic breeds, and at the head of these stand the Cochins, and after them the Brahmas. I place them in this order in consequence of the rapid deterioration in size of the Brahmas, caused, I believe, in a great measure, by years and years of breeding for feather. It may be a cause of objection to some readers that the Asiatic breeds come so low down on the list, but still I must hold to my opinion that these birds are disappointing when all the feathers are off. I am quite aware that some specimens of these breeds have reached the enormous weight of 15 lb., but this, it will be admitted, is exceptional, and moreover, such birds are usually past the age when eating them is a pleasure.

The Langshan has many admirers for table purposes, and I am also looking forward to testing the Orpington, some chicks I have now coming on showing decided proclivities to weight. The Houdan also has very high claims to consideration, and lastly I must not forget to include the result of a cross between Game and Dorking, which will hold its own anywhere for size and flavour.

It will be understood that this article is written with a desire on my part to assist poultry-keepers generally in selecting really good table birds, and I distinctly disclaim any desire to decry the merits of any variety simply by omitting to mention it. Most fowls are good for the table, provided they are healthy, well fed, and young, and my only contention is that my selections give a generally better return for the time and money expended in rearing them; this, I think, is the business way of dealing with the subject, and I wish to treat all poultry matters on a business footing.

Before closing, it is necessary to refer in general terms to some of the fads which are a good deal written about, as "market requirements." Possibly the most prominent of these is the continual insistance on the yellow leg. I shall always maintain that a healthy red comb is of far more importance than a yellow leg. It must be borne in mind that the yellow shank never comes on to the table in a properly-dressed fowl, and as that is the time when one judges of the qualities of a table bird, the colour of the shank would not appear to be of vital importance. Again, the preference for a particular coloured skin may, I think, be similarly disposed of. I should like, also, to anticipate an objection which is likely to be raised in regard to my recommendation that good breeds should be used for the table. All breeders will admit that out of each season's results only a very small proportion will be retained for shows and for the next season's breeding. The majority of chicks are what are known as culls, and this for the most part means that they exhibit some fault in feather or style. These culls, however, mostly possess all the attributes of a breed for table purposes, and it is a well-known fact that all fanciers dispose of their culls every year for human consumption. It is, therefore, apparent, that not only may good fowls be made to pay expenses by disposing of the culls, but, in addition to this the possession of a number of good birds of any known breed is a continual and ready source of profit, and profit is, or should be, the motto of our farmers.

General Notes.

Practical Experiments in Tobacco Curing.

As an outcome of a visit lately paid to the Tumut district by Messrs Lamb and Sutherland, tobacco experts to the Department of Agriculture, a public spirited offer has been made to the Department by Dr. Mason, of Tumut, who takes a practical interest in tobacco-growing. It seems to be evident to Dr. Mason from facts pointed out by the officers that the growth of unsuitable varieties, and the want of a proper method of curing the leaf, are the principal drawbacks of the tobacco industry. He offered to place his tobacco crop at the disposal of the Department, to be cured and prepared for the London market, under the personal supervision of Mr. Sutherland. The Minister having accepted this opportunity of giving practical instructions in better methods of curing, Mr. Sutherland has been despatched to Tumut for several months. During this time he will personally supervise all the work connected with the curing of Dr. Mason's crop, and will also give any assistance in his power to other growers who are anxious to try improved methods.

The financial results indicated by the returns from the London market as the outcome of this experiment will be watched with interest by those who consider that we have the soil and climate suitable for growing tobacco as good as any in the world if we had only the skill required to cure the leaf in such a way as to suit the different purposes of the best manufacturers, in which case we could, after supplying the comparatively small local demand, become exporters of tobacco leaf of a high quality.

The Department has secured samples from New Guinea, Turkey, and Queensland, and has ordered some fourteen of the best sorts from America. These seeds will be divided into small packets, and sent out to such growers as may wish to experiment with improved varieties.

Lecturer and Demonstrator in Fruit Preserving, &c.

It will be remembered that some time back the Department of Agriculture with a view of assisting fruit-growers to utilise to the best possible advantage their surplus fruit, took steps to secure the services of a thoroughly qualified person to visit at the proper season the chief fruit-growing districts for the purpose of giving lectures and practical demonstrations in the art of fruit-preserving, canning, drying, and candying, and in jam, jelly, and pickle making in all their branches. Such instruction, it was hoped, would enable orchardists to overcome the difficulties that now exist in the shape of over-stocked markets and heavy rail freights from districts situated at any distance from large centres of population where there is a demand for fresh fruit.

Fruit-growers and others interested will, however, be disappointed to learn that owing to the determination of the Government not to authorise any new appointments for the present, the Minister has determined that the question of appointing this expert must be postponed.

Pomological Committee.

The formation of a Pomological Committee, announced in our January issue, has been completed by the appointment of the following gentlemen:—

Those nominated by the Fruit-growers' Union are:—

Mr. R. Scobie, M.P., Maitland,
Mr. E. Whitaker, Secretary to the Fruitgrowers' Union, Parramatta,
Mr. J. Morgan, Goulburn,

Those nominated by the Department being,—

Mr. C. W. Mills, Rydalmere,
Mr. T. Reedy, Orchard Manager, Camden,
Mr. J. F. Barnes, M.P., Cootamundra.

A preliminary meeting was held at the offices of the Department on the 23rd February last, when all the members, with the exception of Mr. Reedy, attended, and Mr. H. C. L. Anderson, Director of Agriculture, and Mr. A. H. Benson, Fruit Expert, represented the Department. On this occasion Mr. R. Scobie, M.P., was unanimously elected to the position of chairman. Several subsequent meetings have been held, and a large amount of work performed in the shape of naming specimens of fruit submitted from various districts of the Colony, visiting fruit-carrying steamers, and land cold-storage experiments, as well as the discussion of matters connected with the fruit-growing industry. Meetings are called at intervals, depending on the amount of work to be performed.

Judging Wine Exhibits at Shows.

One of the most difficult positions to fill in connection with the Shows of our various Agricultural Societies is that of Judge of Wines. Not only is it hard to obtain the services of competent men who will undertake the duties without remuneration, but difficulties often arise in the shape of minute differences between wines submitted for judging, which render necessary tests which cannot be made in the ordinary show-room. With a view to assist in promoting a more satisfactory state of affairs, the Minister has decided that the chief wine-exhibiting Societies—such as Albury, Wagga Wagga, Singleton, Maitland, and Inverell—be informed that they may send any samples of wine to the Department to be examined methodically and reported upon in detail by Mr. Despeissis, Viticultural Expert to the Department, in conjunction with Mr. P. F. Adams, of Liverpool, who has kindly consented to give his services in this manner, although unwilling to undergo the fatigue of travelling to the different Shows. By this means a great deal of valuable information will be obtained about the wines of different districts, which cannot fail to be of service to growers.

Analyses and Values of Commercial Fertilisers.

THE farmers, fruitgrowers, and market-gardeners of New South Wales are awakening to the importance of getting the best possible manure for their respective crops, and at the lowest possible price. It has been previously pointed out that the price asked for a manure does not always correspond with its fertilising value. It will be seen, on reference to the analyses of manures offered for sale in Sydney, that some of the prices asked are far in excess of the manurial value of the fertilisers offered, while, in other cases, excellent value is to be obtained for the price charged. During a recent trip to Burrawang, we found some hard-working market-gardeners growing magnificent cabbages for the Sydney market at the rate of 20 to 25 tons to the acre. The soil is naturally rich, but the proprietors have found it profitable to employ manure, not only to force on the young cabbages so as to escape the attacks of moth and fly, but also to increase the yield per acre. They have been using an imported manure sold at £13 10s. a ton. This is, in every way, a genuine and useful manure, inasmuch as it is in no way adulterated, and is judiciously blended; but it is not an economical one, as can be readily imagined, when it is mentioned that an analysis shows its manurial value to correspond, almost identically, with that of a local manure sold at £5 2s. a ton. In England manures have a high value owing to the great demand for them. In New South Wales all manures which are obtained as by-products in our different industries are sold at comparatively low prices owing to the moderate demand. For example, excellent superphosphate is obtainable in Sydney at £4 10s. per ton, which in England would be worth, at least, £6. So with genuine bone-dust, dried blood, sulphate of ammonia, and all other manures produced locally; they are from 20 to 25 per cent. cheaper in New South Wales than in England. The only ones which are dearer here than in England are such as have to be imported from other countries, as, for instance, potash salts and nitrate of soda. As the cheaper manures mentioned above constitute the basis of all our mixed manures, it will be readily seen that the local manufacturers can easily produce an article in every way equal to that made in England, and can sell it at a much lower price.

In fixing the values of these manures the best American and European precedents have been followed. A fixed value per unit has been taken for organic nitrogen, inorganic nitrogen, soluble phosphoric acid, reverted phosphoric acid, insoluble phosphoric acid and potash. These may be considered to indicate pretty closely the manurial value of the compound manures of which they form part. As the unit value, or the value of each 1 per cent. of an element or constituent varies with the market price of the cheapest

form of that constituent, it will be seen at once that the market values of compound manures may vary slightly from time to time. Unfortunately too it is found that the composition of the manures offered for sale also varies occasionally, and it is therefore imperative that manures should be bought only from such honorable firms as can be relied upon to furnish a genuine article with, as nearly as possible, a fixed manurial value. There is no Act in New South Wales to compel manure manufacturers to give a certified analyses of each sample of manure offered for sale, but it is gratifying to know that the best firms in Sydney are perfectly willing to guarantee the composition of their manures within reasonable limits, and to place every facility at the disposal of the Department to gauge correctly the commercial value of their respective fertilisers. To indicate the caution that is necessary in buying manures which may fluctuate in their percentage value we need only mention that three samples of manure have been analysed in the Department which have shown percentages of potash, the sole valuable constituent, varying from 6·21 up to 15·96, or from 38s. 9d. to 100s. in value.

The Department will be happy at all times to furnish as full and exact information as it can to any agriculturist who wishes advice as to the best simple or compound manure that he can employ for his respective crops, having due regard to the mechanical character and chemical composition of his soil.

ANALYSES of Manures offered for Sale in New South Wales.

Manure.	Where obtainable.	Moisture.	Volatile and combustible substances.	Containing nitrogen.	Equal to ammonia.	Insoluble matter.	Lime.	Soluble phosphoric acid.	Insoluble phosphoric acid.	Potash.	Sulphuric acid.	Magnesia.	Value.	Price asked.
Bone-dust	Botany Meat Works Co... ..	....	....	4·20	5·10	2·88	29·35	....	12·74	....	....	....	95/-	95/-
Do	Sydney Soap and Candle Co., Kent-street, Sydney.	5·876	39·274	2·772	3·366	....	....	....	....	....	....	....	98/-	95/-
Do	Abbey Meat Co., Lithgow ..	4·43	19·00	1·841	2·235	18·36	29·808	....	19·556	....	....	....	90/-	....
Do	J. Williams, Lithgow	10·C03	27·113	3·399	4·127	3·323	32·445	....	24·051	....	....	....	112/-	100/-
Do	Mr. Charlish, North Willoughby	5·84	32·71	3·348	3·944	4·46	31·51	....	22·81	....	....	....	120/-	105/-
Do	Riverstone Meat Co., Darling Harbour and Riverstone	5·54	33·41	2·422	2·941	0·45	32·50	....	23·37	....	....	....	110/-	100/-
Do	Australian Meat Co., Copmanhurst, Grafton.	4·511	33·048	2·492	3·026	6·088	....	....	22·733	....	....	....	104/6	80/-
Do (No. 1)	T. Green and Sons, Alexandria	6·281	28·759	2·912	3·536	0·250	31·805	....	26·969	....	....	....	129/-	140/-
Do and meat (No. 2) ..	do do ..	7·918	42·532	4·032	4·896	0·895	....	.....	17 966	....	....	....	111/-	95/-
Coarse Bones	Riverstone Meat Co., Darling Harbour and Riverstone.	6·91	12·22	1·12	1·36	12·82	35·90	....	25·72	....	....	1·51	77/9	60/-
Bone-dust	Bone Mills, Goulburn	6·829	23·348	1·572	1·909	29·696	....	....	12·340	....	....	....	62/-	100/-
Do	D. Davis, Bulli Bone Mills ..	5·830	30·219	3·556	4·318	2·851	27·365	....	23·129	....	....	....	123/-	105/-
*Boiling-down refuse (coarse)	Lake Albert Boiling-down Works, Wagga Wagga.	6·590	36·607	2·820	3·424	6·757	26·632	....	18·538	....	....	....	80/-	30/-
Bone-dust	Australian Chilling and Freezing Co., Aberdeen.	5·731	34·304	2·884	3·502	11·019	25·173	....	19·061	....	....	....	101/-	47/6
Do	Boiling-down Works, Queensland	9·296	36·344	2·453	2·978	7·896	....	....	18·479	....	....	....	94/-	....
Dried blood	Riverstone Meat Co., Darling Harbour.	11·30	80·98	10·08	12·24	4·31	0·87	....	0·62	0·42	....	traces.	125/-	120/-
Do	Glebe Island Abattoirs	11·18	....	10·46	12·70	....	....	....	0·59	0·42	....	....	130/-	120/-
Dried offal	do do ..	6·80	....	6·90	8·39	8·2	....	....	1·89	0·24	....	....	91/-	100/-
Dried blood	Australian Chilling and Freezing Co., Aberdeen.	13·976	77·857	11·479	13·938	3·286	1·273	....	·822	·314	....	....	143/-	92/6
Gee's fertiliser............	Sydney Meat Preserving Works	10·16	58·72	5·30	6·44	0·79	15·37	....	12·66	0·24	....	....	110/-	110/-
Gee's complete P.B.B.......	Auburn	9·5	52·84	4·77	5·79	0·71	13·83	....	11·39	5·00	....	....	128/-	125/-
Colonial Sugar Co's. manures, No. 1.	Colonial Sugar Refining Co., O'Connell-street, Sydney.	11·00	14·00	....	....	2·00	24·00	16·00	2·00	....	23·00	....	92/-	90/-
No. 2	do do ..	11·00	25·00	3·00	3·6	2·00	20·00	18·00	2·00	....	28·00	....	115/-	110/-
No. 3	do do ..	10·00	25·00	3·00	3·6	2·00	19·00	12·00	2·00	2·0	29·00	....	122/-	130/-
No. 4	do do ..	9·00	34·00	5·40	6·5	2·00	16·00	9·00	2·00	4·30	34·00	....	151/-	150/-
No. 5	do do ..	10·00	34·00	3·00	3·6	2·00	17·00	10·00	2·00	7·5	31·00	....	144/-	150/-
No. 6	do do ..	10·00	11·00	....	....	2·00	20·00	13·00	2·00	7·5	26·00	....	121/-	130/-
Fison's orchard manure ..	South Coast and West Camden Co., Sussex-street, Sydney.	....	....	2·99	3·63	4·872	19·884	10·234	5·96	2·041	31·62	....	126/-	210/-
Fison's horticultural manure	do do ..	20·69	27·44	2·68	3·26	3·62	14·81	4·58	5 30	1·38	11·47	....	86/-	270/-
Fison's No. 6 fertiliser ..	do do ..	17·047	47·051	3·509	....	4·041	....	2·507	2·571	4·566	2·425	....	95/-	210/-
Odams' complete manure ..	Holdsworth, MacPherson, & Co., George-street, Sydney.	10·012	23·556	3·501	4·252	7·538	....	11·279	1·289	5·479	....	....	143/-	210/-
Do dissolved bone compound.	do do ..	6·408	29·995	1·960	2·380	5·708	....	11·263	5·270	....	....	....	103/-	170/-
Do superphosphate ..	do do ..	12·824	14·949	·252	·291	3·587	....	16·984	1·294	....	....	....	98/.	130/-
Superphosphate, Thomas' Basic slag.	Jules Renard & Co., Sydney ..	0·793	....	....	....	6·227	39·467	7·628	13·018	....	....	9·446 FeO, 7·286 F2O3	86/-	120/-
Fish manure	Austral Oil and Manure Co., Alexandria.	10·884	59·258	6·097	7·403	5·398	....	....	8·283	....	....	....	102/-	100/-

* A manure exactly similar to this can be obtained at 40/- per ton of H. McNamara, Arncliffe.

ANALYSES of Manures offered for sale in New South Wales—*continued.*

Manure.	Where obtainable.	Moisture.	Volatile and combustible substances.	Containing nitrogen.	Equal to ammonia.	Insoluble matter.	Lime.	Soluble phosphoric acid.	Insoluble phosphoric acid.	Potash.	Sulphuric acid.	Magnesia.	Value.	Price asked.
Phospho guano	Co-operative Acid and Chemical Manufacturing Company, Alexandria.	6·244	45·368	3·290	....	3·574	....	11·811	5·368	0·708	....	....	125/-	110/-
Phosphatic guano	H. Payten, Sydney	....	24·90	0·569	0·691	0·17	25·18	....	11·85	....	....	....	48/-	....
Dissolved guano, Peruvian ..	Gibbs, Bright, & Co., Sydney ..	8·50	44·05	5·74	6·97	7·43	12·18	11·78	....	2·06	....	....	144/-	280/-
Guano from Compton Cave, South Australia.	Kauffmann and Sons, Adelaide	36·09	45·87	4·48	5·44	1·20	7·75	....	5·59	0·46	....	....	76/-	100/-
Guano, South Australia ..	Stimson and Townsend, Fruit Exchange, Sydney, agents.	10·02	16·45	1·036	1·258	17·77	29·58	....	19·39	0·16	....	....	83/-	100/-
Guano, Rocky Islet, near Thursday Island.	Burns, Philp, & Co., agents ..	6·874	10·623	0·751	0·912	9·392	36·016	....	30·445	....	....	....	115/-	100/-
Kainit	Jules Renard & Co., Kent-street, Sydney.	....	....	....	....	....	....	....	....	12·956	11·007	....	77/6	85/-
Do	Agents for A. Blumenthal & Co., Hamburg.	17·75	....	....	....	....	....	....	....	12·01	8·81	6·22	72/-	....
Sulphate of potash	Jules Renard & Co.	....	....	....	....	....	....	....	....	52·376	44·226	....	314/-	260/-
Chloride of potash	Jules Renard & Co., Kent-street	....	....	....	....	....	....	....	....	35·108	....	....	210/-	210/-
Bloodwood ash..	....	....	16·8	....	....	45·1	8·473	....	0·273	5·254	....	4·279	32 6	....
Blackbutt ash	....	....	....	....	....	....	7·276	....	0·044	2·018	0·795	1·568	12/8	....
Red gum ash	....	....	....	....	....	....	....	....	0·383	4·17	....	....	25/6	....
Spotted gum ash	....	....	....	....	....	....	....	....	·098	·690	....	....	4 8	....
Megass	Clarence River Cane	22·86	67·32	0·63	0·78	8·61	0·3010	....	0·0159	0·0495	....	....	8/-	....
Megass ash	do	....	....	....	....	87·09	3·07	....	0·17	0·51	....	1·568	4/-	....
Do	Richmond River Cane	....	....	....	....	....	1·112	....	0·281	4·795	....	0·7225	29/9	....
Seaweed ash	....	....	....	....	....	....	9·269	....	0·491	0·591	1·910	3·077	5/3	....
Sulphate of ammonia.. ..	Australian Gaslight Co., Sydney	6·59	....	20·44	24·82	....	....	....	....	....	58·57	....	265/-	260/-
Soot	Sydney Practical Chimney Sweepers' Association. (R. Scotney, Grove-street, Petersham).	....	....	3·08	3·74	26·82	2·98	....	....	....	....	....	40/-	40/-
Flue deposit	From Maitland	1·337	4·624	0·064	....	83·751	2·564	....	0·321	0·309	....	....	3/10	....
Do	From Liverpool	·672	1·212	....	....	91·178	·426	....	1·296	·172	·288	·235	5/-	....
Poudrette	Poudrette Co., Botany	7·80	30·96	1·40	1·70	40·92	4·30	....	3·09	2·11	....	1·14	40/3	100/-
Wool scouring tanks deposit, No. 1.	Liverpool Wool-scouring Works ..	....	....	0·6412	0·7786	....	....	....	0·004	0·7224	....	....	12/-	....
No. 2	do do ..	....	....	1·022	1·2410	....	....	....	0·1608	0·7064	....	....	17/-	....
No. 3	do do ..	....	....	1·3720	1·6660	....	....	....	0·1382	0·3896	....	....	19/-	....
Tanyard refuse	Tanneries, St. Mary's District ..	6·43	33·83	2·24	2·72	21·48	26·96	....	0·672	0·106	....	....	30/-	....
Decomposed hair and lime ..	Fellmongeries	9·702	57·079	6·861	....	1·218	26·270	....	....	....	....	....	32/-	....
Filter press muck	Cane Mills, Broadwater	16·39	26·07	·222	·27	34·86	13·20	4·94	1·04	0·44	....	....	35/-	....
Cave deposit—Shells, &c., from cave.	Cowan, Hawkesbury River ..	2·113	....	·820	....	....	35·402	....	1·596	·887	1·325	....	20/-	....
Albert's chemical manure } Thomas' phosphate, No. 1 }	Jepson Bros., Clarence-street, Sydney.	....	....	....	....	....	41·250	12·267	5·245	....	....	....	86/-	85/-
Concentrated superphosphates, No. 2.	do do	16·856	....	....	....	2·244	....	47·088	0·409	....	....	....	252/-	215/-
Concentrated horticultural manure.	do do	16·008	....	11·121	....	1·786	....	15·574	....	22·208	....	....	360/-	460/-
No. 4 Vineyard manure P.K.N.	do do	6·684	....	6·525	7·928	....	....	21·870	....	33·367	....	....	401/-	490/-

AGRICULTURAL SOCIETIES' SHOWS, 1893.

Society.	Secretary.	Date of Show.
Castle Hill A. and H. Association...	F. H. G. Rogers	April 3, 4
Wellington P. and A. Society	R. Porter ...	April 12, 13
Liverpool Plains A. and H. Association	F. T. R. Veness	April 19, 20
*Mudgee Agricultural Society	J. M. Cox ...	April 19, 20, 21
Namoi P., A., and H. Association	J. Riddle ...	April 12, 13
*Dubbo P., A., and H. Association	G. H. Taylor ...	April 26, 27
*Upper Hunter P. and A. Association, Muswellbrook ...	P. Healey ...	May 3, 4
Warialda P. and A. Association	W. B. Geddes ...	May 3, 4
Williams River A. and H. Society...	W. A. Smith ...	May 3, 4, 5
Coonamble P. and A. Association	F. R. Salt ...	May 10, 11
*Gunnedah A. and P. Association	F. P. Brigstocke	May 17, 18
*Central Australian P. Association, Bourke	J. P. Martin ...	May 31, June 1
Warren P. and A. Society	F. C. Thompson	June 7, 8
Nyngan P. and A. Society	E. H. Prince ...	June 14, 15
Cobar P. and A. Association	A. Roxburgh ...	June 21, 22
Riverina P. and A. Society, Jerilderie	M. Curtin ...	July 25, 26
Gwydir P. and A. Society, Moree...	S. G. Cohen ...	July 25, 26

* These Societies get District National Prizes.

The following Shows have been postponed in most cases in consequence of the recent floods:—Clarence P. and A. Society, April 12, 13; Richmond River A., H., and P. Association, April 21, 22; Hunter River Society (Maitland), April 26, 27, 28.

[Four plates.]

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THE

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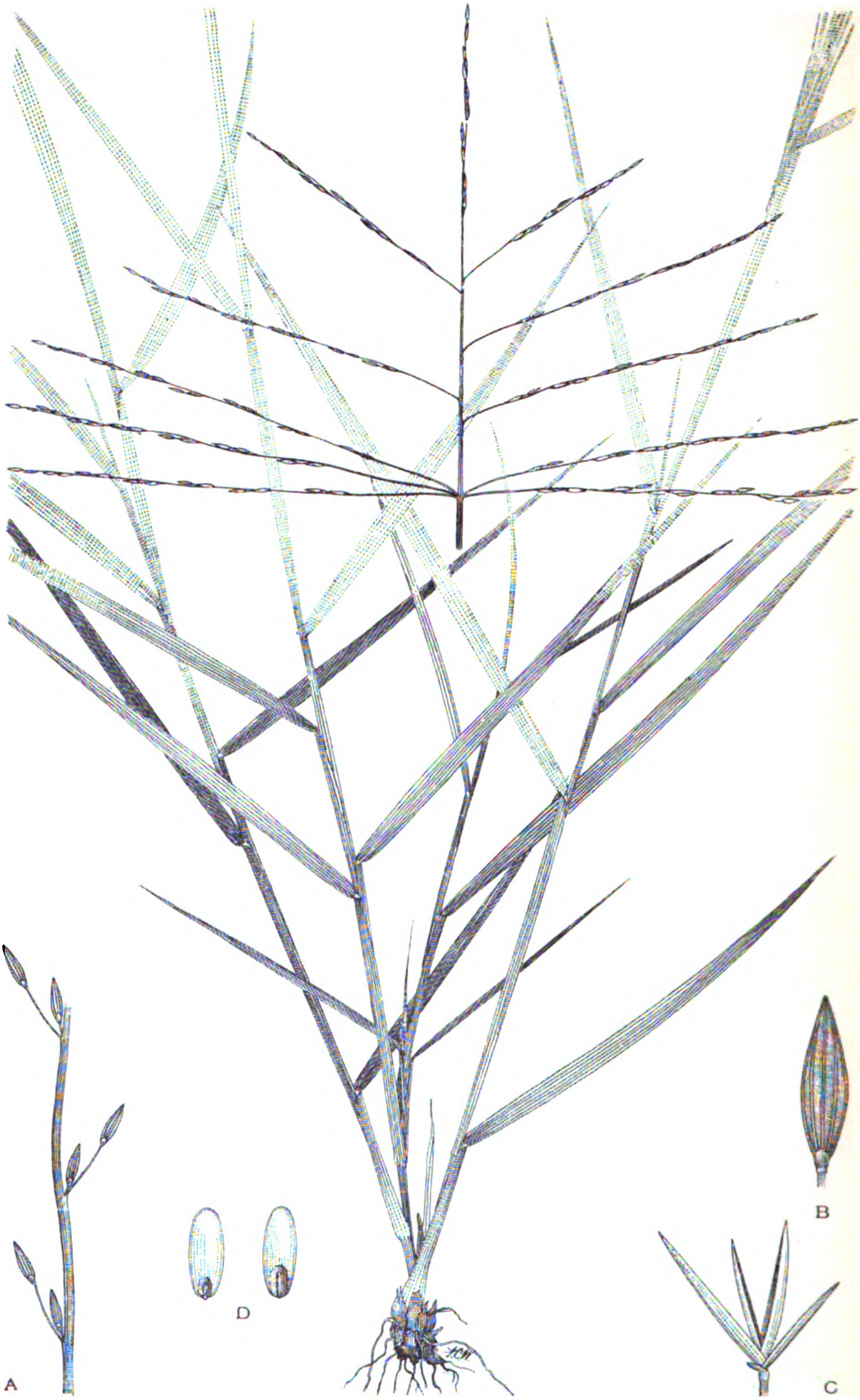
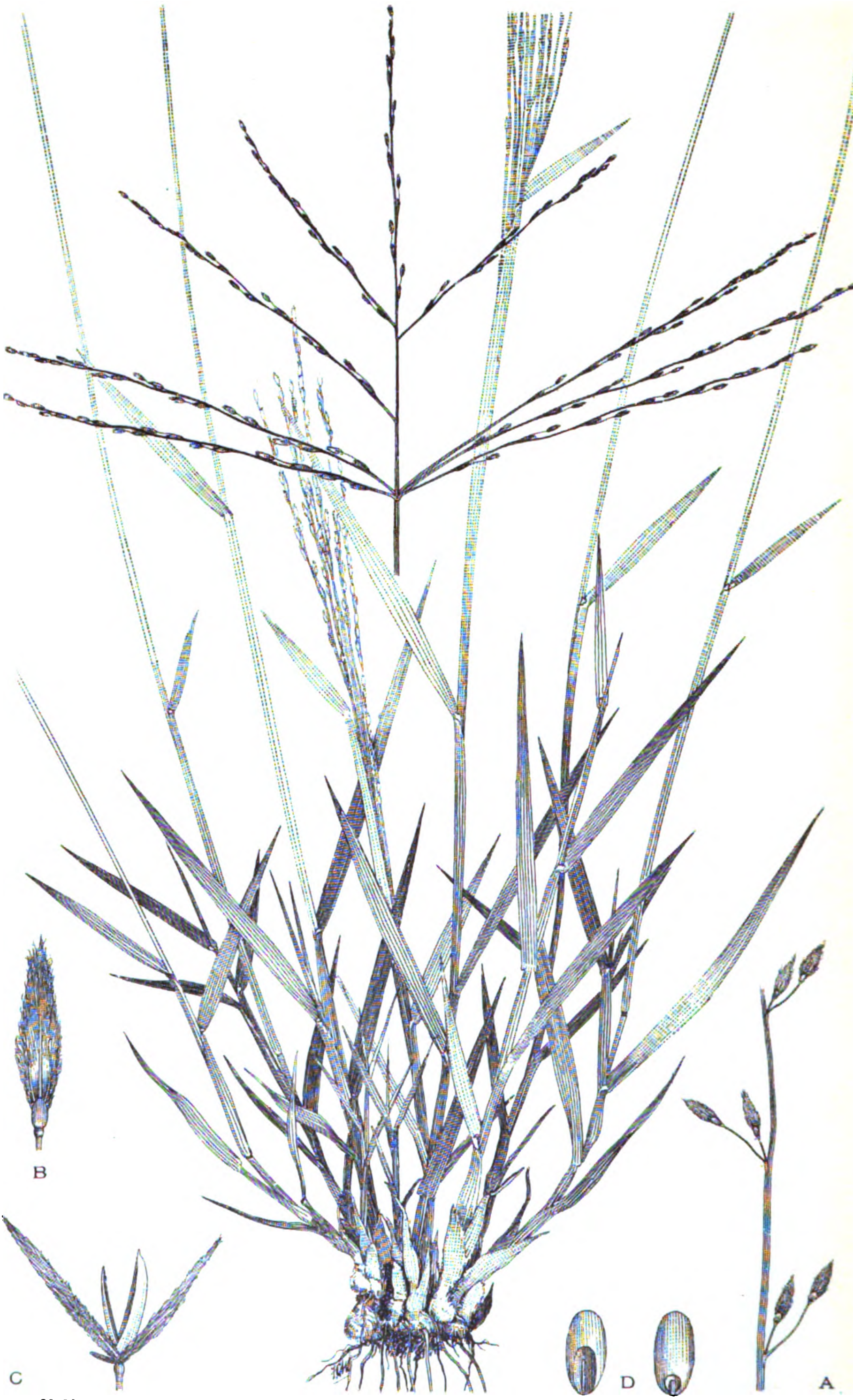


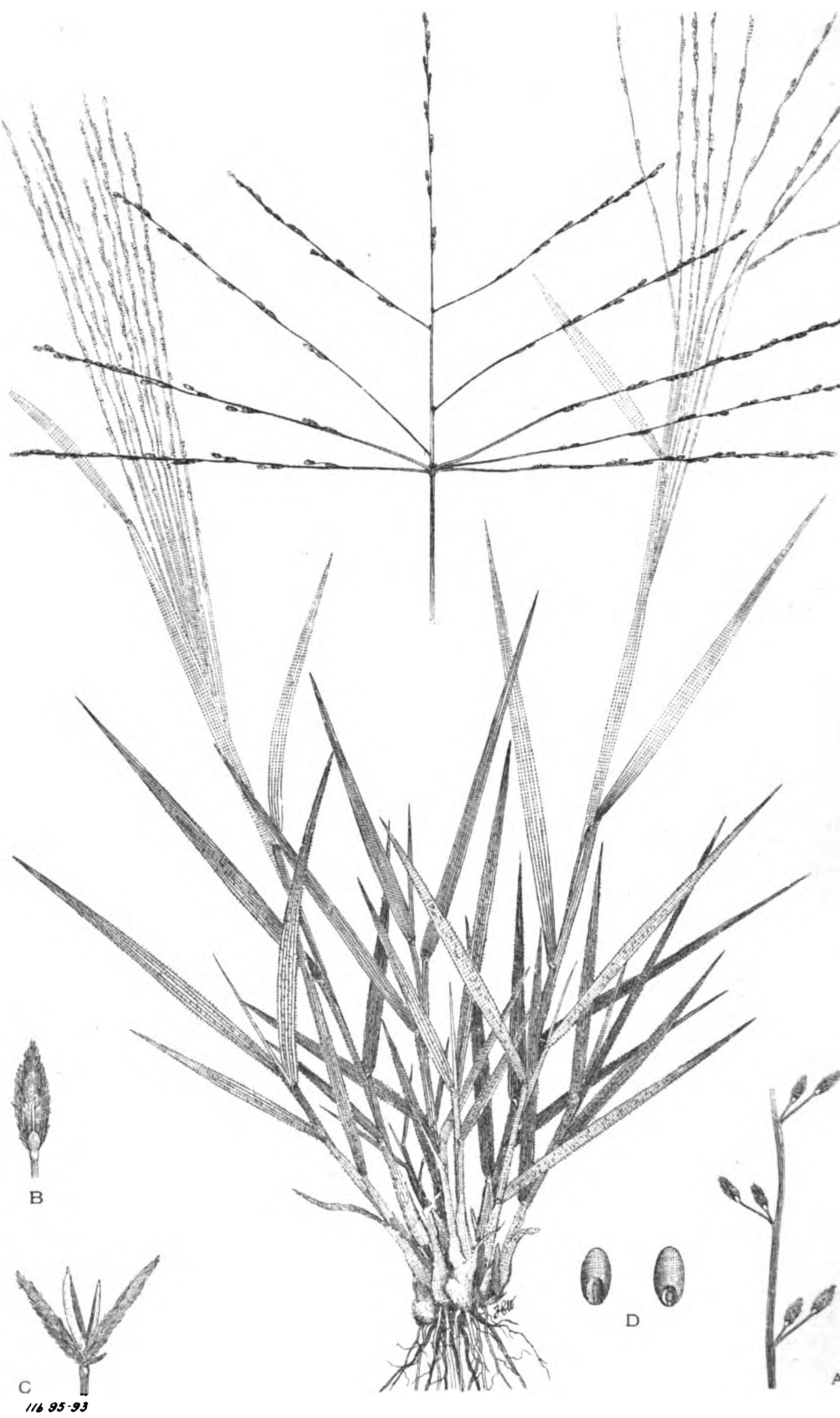
Panicum divaricatissimum, R. Br. Var. glaberrimum.

"Umbrella Grass."



Panicum divaricatissimum, R. Br. Var. normale.

"Umbrella Grass."



Panicum divaricatissimum, R. Br. Var. ammophilum.

"Umbrella Grass."

Vol. IV, Part 5. MAY.

The Grasses of Australia.

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By FRED. TURNER,
Department of Agriculture.

PANICUM DIVARICATISSIMUM, *R. Br.* "Umbrella Grass."
Flora Austr., Vol. VII, p. 467.

STEMS from a branching base, sometimes under, sometimes much above 1 foot high. Leaves glabrous, or more or less pubescent or softly villous, the ligula not prominent and not ciliate. Panicle of rather numerous rigidly filiform simple branches 3 to 8 inches long, at first erect, at length spreading, the lower ones in a dense verticil, the upper ones alternate and distant. Spikelets in pairs or rarely solitary along the branches, one almost sessile, the other pedicellate, one to one and a half lines long, glabrous, or covered with long silky hairs, spreading when in fruit. Outer glume very small, ovate, obtuse, the second and third nearly equal, and both empty, or the third rarely with a minute rudimentary palea, the second usually three-nerved, the third five-nerved. Fruiting glume ovoid, not gibbous, glabrous, smooth, acute. Grain enclosed in the hardened fruiting glume and palea, but free from them.

There appear to be four rather marked varieties, but scarcely definite enough to be regarded as distinct species. They are :—

(1.) *Var. glaberrimum*, stems tall, branches of the panicle sometimes more than 8 inches long, the whole plant glabrous; spikelets 1½ lines long, glabrous.

(2.) *Var. normale.*—Foliage glabrous, or nearly so; panicle branches 4 to 8 inches long; spikelets 1½ lines long, silky, villous, rarely nearly glabrous.

(3.) *Var. ammophilum.*—Foliage softly villous, spikelets small, covered with long silky hairs spreading when in fruit.

(4.) *Var. radiatum.*—Foliage softly villous, spikelets small, glabrous or nearly so.

Three of the principal and apparently most common varieties of this species are figured in this issue. This was done with a view to obviate the mistakes that might occur with regard to the identification of the grass. Two of the varieties have been described as distinct species by different botanists, but when the various forms are brought under careful microscopical examination, their principal differences are not very great, as will be seen by referring to the dissectional drawings in each of the plates. The

spikelets of some of the varieties are glabrous, whilst in others they are more or less covered with silky hairs. The foliage also is glabrous in some varieties, whilst in others it is softly villous. These are the principal differences from a practical point of view.

This grass is, in one form or another, found in all the Australian colonies except Western Australia, from the coast to the arid interior, and in many places it is very plentiful. It seems to adapt itself almost to any kind of soil, as it may be found growing on those of a light sandy nature, on rich alluvial flats, on the red chocolate plains of the interior, and also on limestone formations; and under these varied conditions it appears to grow equally well. The varieties that grow in the interior, however, are usually more dwarfish in habit than those that are growing in the coastal districts. This, of course, may be accounted for by the greater rainfall in the latter than in the former portion of the continent. The roots of this grass are very strong and wiry, and they generally penetrate the earth to a great depth, which, no doubt, enables the plant to withstand a great amount of dry weather. I have seen some forms of this species beautifully green in the interior when the surrounding herbage was dry-looking. When in seed the wide-spreading panicles give the grass rather an uninviting appearance, and after they become dry they are often blown into great heaps against fences, &c. Notwithstanding this, however, it is an excellent pasture grass, and during the summer months yields a quantity of valuable herbage which stock of all descriptions are remarkably fond of, sheep often eating it down to the roots. I have seen the variety *glaberrimum* cut and made into excellent hay. All the varieties are worth conserving in those parts of the country where they are already growing, and disseminating where they do not already exist. Under ordinary conditions most of them produce an abundance of seed, which usually ripens in November and December, but occasionally in the autumn months.

Reference to Plate.—A, showing the arrangement of the spikelets on the rhachis; B, showing the relative size of the outer glume on the spikelet; C, a spikelet opened out, showing the four glumes and palea; D, grain, back and front views, all variously magnified.

Vegetable Novelties.

By GEO. VALDER,
Department of Agriculture.

HAVING obtained a number of vegetable novelties from various seedsmen in the different colonies, and also a few packets of Japanese seeds which had been presented to the Department by Mr. John Young, of Annandale, I decided to test the whole of them in my experimental plot at Croydon, near Sydney.

The greater portion of these novelties belonged to the cucumber tribe (*Cucurbitaceæ*), and these were sown in a bed prepared as follows:—

The land selected for the experiment had for some years been used as a grass paddock, and had lately been ploughed, cross-ploughed, and harrowed. I measured off a bed 30 ft. x 15 ft., and finding that the soil was not thoroughly broken up I carefully dug it over. I then placed pegs in, 6 feet apart each way, commencing 3 feet from the edge; this gave fifteen pegs to the bed. I then made a hole at each peg, about 2½ feet in diameter, taking out the topsoil; then removed a large bucketful of the subsoil, and placed the topsoil back in the hole, having first mixed a bucketful of well-rotted stable manure with it. Into each hole I stirred ½ lb. of Sugar Co.'s No. 5 manure (this is equal to 5½ cwt. per acre, costing 44s.), and then placed about 1 inch of fine soil on the top of this for the seed to be sown in. I planted eight seeds in each hole, afterwards thinning the plants so that only three were left.

The remaining seeds were sown in drills, 2 feet apart, and the plants thinned out from 6 to 18 inches apart. No. 5 manure, sown broadcast at the rate of 4 cwt. to the acre, was the only manure used.

Japanese Seeds presented by Mr. John Young.

No. 1. *Cucumis* (common).—Seed sown on the 15th October germinated in eight days. The plants grew very rapidly, and were very similar in every way to the common cucumber. The first fruits were fit to cut on the 9th January (eighty-six days from time of planting). In shape they much resembled the long green smooth cucumber, but were much more handsome, being of a beautiful light green colour, and having a very distinct silvery bloom. They measured from 9 to 14 inches in length, with a diameter of from 1½ to 3 inches. Cut in slices and served up with vinegar and pepper it was found that they were much coarser than the ordinary cucumber, and almost flavourless; as a salad they were certainly not a success. Peeled, cut in quarters, and boiled for nearly an hour, I found they made a delicious vegetable, especially when served up with melted butter. When cooked in this manner they are quite firm, but very tender, and have a fine flavour, something between the ordinary cucumber and a custard marrow. The yield was not very heavy, being nineteen fruits from three plants.

No. 2. *Cucumis melo* (silver).—Seeds sown on the 15th October germinated on the 24th. Plants similar to No. 1, except that the leaves were smaller and stems much shorter. The first fruits were cut on the 6th January (eighty-three days from time of sowing). They were pear-shaped, most of them being similar in shape and size to the ordinary flat baking pear. They were dark green in colour, with light stripes running from stem to apex. This fruit seems to be a cross between a cucumber and a small rock melon. I tried cooking it in several ways, and also tried it as a salad, but cannot say that it was a success either way. It is probably one of the fruits used by the Japanese in their chutneys. The yield was slightly less than that No. 1, being sixteen fruits per hole of three plants.

No. 3. *Cucumis melo.*—Seeds sown on the 15th October germinated in six days. This turned out to be a small variety of green-flesh rock melon, measuring 6 to 8 inches in length, with a diameter of from 2½ to 3 inches. Although of rather a fine flavour, I do not think that it is equal to several of the larger varieties of green-flesh rock melons, such as Skillman's Netted and Emerald Gem. It was a very heavy cropper, yielding no less than thirty-four fruits per hole of three plants. The first fruits ripened on the 14th January (ninety-one days from time of sowing).

No. 4. *Togan.*—From the appearance of the seeds it was gathered that this plant also belonged to the cucumber tribe. It was therefore treated in a similar manner to the above crops. The seeds were sown on the 29th October, and they germinated on the 9th November, eleven plants being obtained from twelve seeds. The plants grew very strongly; in appearance they much resembled water-melons, except that the leaves were darker and the runners were shorter, and more branched. The young fruits were densely covered with hairs, but as they ripened these fell off, and the fruits then became quite glabrous. The first crop of fruits, consisting of about a dozen, were fit to cut on the 3rd March (*i.e.*, 124 days from time of sowing) On comparing this melon, I found that it was identical in every way with the variety offered by Messrs. Anderson & Co., seedsmen, Sydney, under the name of "Snow" melon. It turned out to be a very good preserving variety, quite equal to the best of the preserving melons grown here. The total crop obtained was twenty-six melons, weighing 243 lb.

No. 5. *Raphanus sativus* (Slender Roots).—Sown 21st January; ready for pulling, 3rd March. This turned out to be a white radish of about 4 inches in length and 1 inch in diameter, rounded off at the base, and of nearly the same thickness throughout. In appearance and flavour much resembles the variety sold by seedsmen under the name of "Californian White Giant."

No. 6. *Raphanus sativus* (Nerima).—Sown at same time as No. 5. Also a white radish, but very long and tapering, most of the specimens measuring nearly 1 foot in length when quite young. Produced a heavy crop of very coarse leaves. Neither of these radishes are equal to the varieties grown here, as they are slower in growth, and of a very coarse flavor. In order to give them a thorough trial I sowed them in alternate drills with the common round and long radishes.

Nos. 7, 8, and 9. *Brassica campestris; B. campestris* (rather long); and *B. chinensis*, proved to be three varieties of loose-leaved cabbages, the two former being turnip-rooted.

No. 10. *Daucus carota.*—Did not germinate.

From my experience with these Japanese vegetables, I certainly think that they fall very short in value, both as regards quality and yield, in

comparison with the best varieties of the same order grown here, and with the exception of the two melons (rock and preserving), I do not think any of them are worthy of further trials. They were all carefully cultivated, the season was very favourable, and the plants were very strong and healthy, therefore the conditions under which they were grown were in every way suitable for a very favourable trial.

White Apple-shaped Cucumber.

I obtained a packet containing eleven seeds of this cucumber from Messrs. P. L. C. Shepherd and Son, seedsmen, Pitt-street, Sydney. I planted these seeds in two holes on the 22nd October, and nine of them germinated on the 28th. When the young plants had grown fairly strong, I transplanted three of them to another hole close by, thus making three holes of three plants each. The weather being very favourable, the plants grew rapidly, and the first crop of fruits was ready for cutting on the 27th December—that is, sixty-six days from time of planting. From this time until the middle of February these nine plants produced from three to five dozen fruits per week, the total number obtained being no less than 274. This cucumber is well-named, as the fruit is quite apple-shaped. The smallest fruits weighed from 4 to 5 oz., and the largest from 8 to 11 oz., the average for the whole being 6¼ oz. The yield was a remarkable one, as, on calculation, it will be found that this is equal to no less than 110,513 fruits per acre, weighing 18 tons 10 cwt. 2 lb. 8 oz. I submitted a sample to Messrs. Stanley & Co., the well-known greengrocers of George-street, Sydney, and they stated that these cucumber were worth at the very least 1s. per dozen wholesale. This would give a return of no less than £460 9s. 5d. per acre. Of course, I do not mean to advise cultivating this cucumber on a large scale, as there would only be a very limited market, but I certainly recommend everyone who has a vegetable garden to plant at least a few holes of them, for in every way they are a desirable vegetable. Cut in slices and served up with vinegar and pepper, they are a very good salad, being superior to the common cucumber in flavour, and more easily digested. People who cannot eat the ordinary cucumbers without being ill, say that they can eat the apple-shaped variety without suffering any ill effects therefrom. Peeled, boiled whole, and served up with melted butter, in the same manner as vegetable-marrow, they make a delicious vegetable, much superior to most varieties of marrow.

Egyptian Prolific Vegetable Peach.

I obtained a packet of seeds of this plant from Messrs. Adamson & Co., seedsmen, Melbourne. They were sown on the 15th October, and they germinated on the 24th. The plants were rather slow in growth at first, but grew very rapidly after the weather became warmer. In appearance they are much like cucumber plants, but the leaves are smaller, and the runners more branched. The first green fruits were cut on the 6th January, these were cut into slices and fried in batter, in accordance with the directions sent with the seeds. When cooked in this manner they make a delicious vegetable, much resembling the tomato in flavour. The ripe fruits were made into jam, a portion of them being flavoured with green ginger, and another portion with the addition of a few lemons. The result was very satisfactory, especially so with the portion flavoured with lemons. The jam is very clear, and has a decided melon flavour. I submitted it to several good judges, and they all spoke highly of it. In size the fruit is about as

large as an orange. They are very handsome, being of a beautiful golden colour, and very even in shape. They are quite a distinct fruit, and I believe, have rarely, if ever, been grown in this Colony. The yield was a very fair one, two holes, of three plants each, giving ninety-four fruits. I do not think this fruit will ever be largely cultivated, but is certainly worthy of a small space in any vegetable garden. It should be cultivated in the same manner as the rock melon.

Rock Melons.

Improved Cassaba.—The seeds of this variety were given me by Mr. Benson, the Departmental fruit expert, he having brought them from California with him. Regarding its qualities he says that it is reckoned the largest and one of the best flavoured of the many varieties which are cultivated in that State. The seeds were sown on the 10th October, and they germinated in about nine days, nearly every seed being good. The plants grew very strongly, and although this was the largest variety which I had under cultivation, it was the first to ripen its fruits. They certainly bore out the high character given them by Mr. Benson, as they were not only very large, but were very richly flavoured and also very handsome, being even in shape and highly coloured. The total crop obtained was fourteen melons from one hole of three plants. The largest of these weighed 26 lb. 7 oz., and the smallest 5 lb. 13 oz. The first fruits were ripe on the 16th January, ninety-three days from the time of sowing.

Rock Melons—"Emerald Gem," and "Holborn Favourite."—Seeds of these two varieties were given me by Mr. Richardson, of Orange, who had obtained seeds from Messrs. Carter & Co., the well-known London seedsmen, the previous year, and had been very successful with them at his farm near Orange last season. Mr. Richardson told me that he thought they were far superior to most of the rock melons grown in this Colony, and I certainly can bear him out in this statement, for the fruits I obtained were very superior in every way, and the plants were very productive. The "Holborn Favourite" is nearly round, has a beautiful light yellow rind, and is heavily netted, the flesh is a very light green, with a sweet melting and juicy flavour. It is a very strong and vigorous grower, and a heavy bearer. The "Emerald Gem" is a valuable green-flesh variety, handsome in form, dark green skin, ripening to a deep yellow, in flavour decidedly the best green-flesh melon I have ever tasted. Is also a very heavy bearer. Neither of these melons were very large, most of the fruits being from 4 to 6 lb. in weight.

Botanical Notes.

Death of Dr. Woolls.

It is with sincere regret that we have to record the death of the Rev. Dr. Woolls, F.L.S., which took place at his residence, Burwood, on the 14th March last. Quite apart from the respect in which he was held as a clergyman and schoolmaster, his loss will be keenly felt in the world of botany. This was a subject which all his life had possessed great fascination for his studious habits, and many of his school pupils, animated by his great love of botanical research, have, in their later years, become ardent amateur botanists. In the botanical world he will be remembered by his works "Plants of New South Wales," "Plants of Parramatta," "Lectures on the Vegetable Kingdom," a "Contribution to the Flora of Australia," and his cultured communications to the leading botanical journals. After his retirement from the ministry he still continued his researches amongst the flora of Australia, and his advice and assistance was at all times at the command of any inquiring student who chose to communicate with him. He was ever an ardent friend of the Department of Agriculture, and took the most lively interest in the botanical work of the *Gazette*. His visits to the Department were many, and always welcome, and his kindly greeting and ripe knowledge will be greatly missed by the Departmental Botanist.

Australian Flora.

From a circular which has reached us from Mr. F. M. Bailey, F.L.S., &c., Colonial Botanist of Queensland, we learn that it is that gentleman's intention to compile for publication a supplementary volume to the "Flora Australiensis." Amongst the reasons which Mr. Bailey gives for undertaking this work, all of them being excellent, he points out that it is thirty years since the publication of the first volume, and fifteen years since the last appeared, and in the latter period not less than 1,100 to 1,200 plants have been added to the known Flora. When it is known, however, that a majority of these plants belong to Queensland, and that most of these have passed through Mr. Bailey's hands, there need be no apology offered by that gentleman for undertaking the work. That the work is to be undertaken in the proper spirit is evident from the announcement that all the orders, tribes, genera, species, &c., will be numbered to agree with the seven volumes of the Flora so as to facilitate reference, and that the only deviation from the arrangement there followed will be where such is authorised by the "Genera Plantarum" of Bentham and Hooker. It is to be sincerely hoped that Mr. Bailey will receive the cordial support of all colonial botanists, and that he will be enabled to bring his great and self-imposed task to a successful issue.

ABNORMAL INFLORESCENCE OF GRASSES.

A SHORT time ago the Honorable W. H. Suttor, M.L.C., and the late Rev. Dr. W. Woolls, F.L.S., brought to this Department some abnormal specimens of the common "couch" grass, *Cynodon dactylon*, Pers., for examination. It was only on some of the spikes at the end of each peduncle that the abnormal development took place, and, singular to say, in the middle of each spike. Near the base, and also near the apex, the spikelets were mostly in their normal condition. The abnormal spikelets had two fertile flowers, and in a few instances a rudimentary third one, "a freak of nature" which has not hitherto been observed and recorded in this country. In the normal form the spikelets are one-flowered, as will be seen on reference to the figure and description which appeared in Vol. II., page 238, *Agricultural Gazette.*

The Rev. F. E. Haviland, Gulgong, New South Wales, forwarded to this Department a specimen of the "star" or "windmill grass" (*Chloris truncata*, R. Br.) with the spikes arranged in two series, the secondary peduncle, produced from the apex of the principal one, which carried a second series of spikes, was about 2½ inches long. In a letter accompanying the specimen, Mr. Haviland stated that he had "seen several cases of it in scattered localities about this district."

Report on the Tobacco-growing Industry in the Tumut District.

By S. LAMB and G. F. SUTHERLAND,
Department of Agriculture.

TOBACCO-GROWING having been successfully carried on in this district for upwards of twenty-five years, and Tumut tobacco having the reputation of being the best grown in the Colony, it is unnecessary that we should enter into any detailed examination as to the suitability of its soil and climate for the tobacco crop. The district has been so frequently visited, and so fully described by officers of the Department, that it is not needful that we should describe at any length its physical or geological features. It will be sufficient to say that it is an upland valley about 800 feet above the sea-level, and that its soil is for the most part a fine alluvial deposit of extraordinary richness, diversified by areas of brown or reddish soil (which are not so rich) on the higher levels.

The cultivation of tobacco has hitherto been confined almost exclusively to the rich flats on the river banks, which in the past have yielded large crops of heavy strong leaf, which suited well the requirements of Sydney manufacturers, who have encouraged its growth to the exclusion of other possibly more valuable varieties. The river flats are subject to frequent inundations, notwithstanding which the tobacco planted after the subsidence of the floods seems to have thriven well.

The average crop of late years has been somewhere about 1,200 lb. per acre; but we are informed that formerly the yield was much greater, a ton to the acre being frequently harvested in good seasons. The price paid to the farmers has always been subject to fluctuations, as much as 7½d. to 8d. per lb. being frequently paid, even in plentiful seasons, but since 1889 a lower range of prices has ruled, the production having overtaken the demand. The price at present ruling is somewhere about 3½d. to 4d. per lb. for best leaf, and there is a very large stock, over 200 tons, still in growers' hands, for which there is no sale even at these low prices. This, notwithstanding that for the last two years the crops have been very small.

The area of available tobacco land in the district is of great extent, covering thousands of acres.

The cultivation which was formerly carried on by Europeans has of late fallen entirely into the hands of Chinamen, who rent land from the owners, but there are many amongst the farming class who are well acquainted with the industry, and would again engage in the cultivation if there was any assured market for their produce.

The kind of tobacco mostly grown in a coarse strong leaf, derived from one or other of the Kentucky varieties, it is not easy to say which, for having been grown in this locality from its own seed for many years it has

acquired a character of its own. It grows very low, has a very thick midrib, the leaf is long and pointed, and has very prominent veins running at an acute angle to the midrib. This character renders it unsuitable for export to European markets, which require a broad leaf with a thin midrib, and very fine veins running as nearly as possible at a right angle to the midrib.

The method of cultivation is extremely faulty from the seed-bed to the harvesting. The seed-beds are badly prepared; the seed too thickly sown; the method of shading the seed beds is contrary to every requirement of successful cultivation. When the seed-bed is sown, it is covered with layers of rushes or grass, which are kept watered. The rapid evaporation of the moisture during the heat of the day chills the earth and retards growth. The beds being kept covered, there is no access of light or air, consequently the generation of fungi is directly encouraged, while the cool moist condition of the grass renders it a favourite cover for every enemy of the infant plant. When at last the beds are uncovered, the direct rays of the summer sun beat upon a mass of sickly emaciated plants. *Peronospora* and the grubs have done their work, and the plants quickly die. It speaks well for the vitality of the plant and the fertility of the soil that under such unfavourable conditions large crops have ever been grown.

After planting out, the same kind of shading is used, and the young plants have to continue the struggle for existence some days longer—under the same disadvantage of deprivation of light and air, and with the same concomitant of grubs, slugs, and beetles.

Priming.—The operation of priming is the removal, after they have accomplished their work, of the primary leaves. This should be done as soon as they begin to fade. The object of it is to admit light and air to circulate and to render it more easy to hoe up and scarify around the roots of the plants. The Chinamen, so far as we have seen, do not remove these primary leaves, but allow them to remain on the plants, and such of them as do not rot on the ground are gathered and dried to form part of the crop under the name of No. 2 tobacco. The proper destination of these leaves is either the fire or the dung-pit. The destruction of these leaves will not diminish the price obtainable for the crop as a whole. The weight may be less, but the value will be greater.

The topping and subsequent suckering of the plants is duly attended to, so far as we have been able to see or learn. Topping is the nipping out of the flower buds, in order that the strength of the plant, instead of being expended on the production of flowers and seeds, which are not wanted, shall be thrown into the leaf, making it stouter and tougher. This operation should be done with judgment and discretion. Plants that are weakly should be topped low, leaving only as many leaves as the plant seems strong enough to mature; more robust and strong-growing plants should be topped higher, in proportion to their strength. Harvesting will not commence here until about the middle of March, we, therefore, defer any remarks respecting it until we have seen the method employed, but we are struck with the crude and insufficient appliances provided for the drying and bulking of the crop. The sheds are open on all sides, the only defence against wind and rain being the hanging from the wall-plates of the Osnaburg or Hessian that is afterwards employed in baling the crop for market. It is utterly impossible to cure tobacco successfully except in closed sheds, with a proper proportion of ventilating doors and windows, which can be opened or closed, as the state of the weather and the condition of the tobacco renders more or less air and moisture necessary. The sheds are roofed with corrugated iron, upon which the moisture from the tobacco

condenses at night, and from which it drips upon the leaf. Every drop makes a stain on the leaf if dry, or if the leaf is still green it causes decomposition. Shingles, bark, or thatch are far preferable for this and other reasons. If only iron is available the roof should be pitched very high, or some sort of ceiling contrived which will moderate the heat at midday and prevent the drip at night.

No separate curing houses are provided. The tobacco is bulked in the open shed, and only screened from atmospheric changes by a covering of bagging stuff. Curing, in the proper meaning of the word, is quite out of the question under these conditions.

The low range of prices current for Colonial tobacco now, as compared with 1889, is the direct result of the heavy crops and large plantings in that and the following year, and the absence of any outlet by way of exportation of the surplus produced above the quantity required by Sydney manufacturers.

If the quality and condition of the leaf had been such as would have rendered it saleable in the open markets of the world, it would have found its natural vent by export. Several attempts have been made so to dispose of it without success. A sample was sent to England and one to Scotland from Tumut, but in both instances, while they were favourably reported on as respects colour and flavour, they were condemned on all other points. One bale was sent from Hillas Creek to a very eminent firm of tobacco brokers in London, and as the report very fairly describes the whole of the tobacco grown in this district, and confirms our already expressed opinion of it, we transcribe it here:—

"Having now sampled the bale of Australian tobacco leaf, we beg to hand you report thereon. The condition is not dry enough for this market, and it possesses nearly every defect. It is nearly every colour but the right one, which should be a level ripe brown colour. It is also mottled. It is very gummy, and will not, therefore, absorb any water. The only thing in its favour is that the leaf is large and tough, but it has also some smaller, imperfect, holey, unripe, and flimsy leaves. The stalks and veins are very large, and light-coloured. The flavour is fair, but requires a lighted match beneath it to make it burn, and some of the tobacco is blistered. Because of its easy condition we cannot value it at more than 1d. to 1½d. per lb. nominal. The tobacco for this market should be dry, well butted, small stalk, and veins of the same colour as the tobacco, a good sized leaf, and perfectly cured, without holes or blisters, and of level, ripe, brown colour. Any other information we shall be pleased to give you, and are yours truly.—A. B. Bremner & Co. 9 January, 1889."

It will be seen from this report (and the one from Edinburgh was almost identical in terms) that the points unfavourably reported upon were those which depend upon the handling and treatment of the crop, whilst those points which depend chiefly on the soil and climate, namely, flavour and texture, are favourably mentioned.

If leaf grown from probably the commonest and coarsest variety of tobacco in cultivation, cultivated with the smallest possible amount of knowledge on the part of the grower, improperly and only partially cured, has developed a flavour which a critical London broker admits to be fair, and a practical Scotch manufacturer declares to be good, it is a fair inference that if the best kind of seed were sown, the best methods of cultivation employed, and the resulting crop properly cured, well graded, and nicely got up for the market, a ready sale would be found for all we could send to the United Kingdom, while at the same time the improvement in the quality would

enable Sydney manufacturers to use a larger quantity of Colonial and import less American leaf. For the correct appreciation of this subject it is necessary that we should explain what the requirements of the English market are. Briefly, the kinds of leaf mostly in request in the home markets are:—

1st. Good, sound, full-bodied leaf for spinning into twist, and making up into plug and cavendish.
2nd. Good, sound, coloury leaf for cutting into shag, bird's eye, and returns.
3rd. Fine, yellow, aromatic leaf for cutting into flake-cut and fancies, the higher grades of which are used for cigarette-making.
4th. Fine, silky, glossy leaf, of cinnamon-brown colour, tough, but with very thin veins for cigar wrappers.
5th. Good, clear—burning leaf of any colour, suitable for bunch-wrapper in cigar-making—that is, the inside skin of the cigar before the wrapper is put on.
6th. Any really well-flavoured good-burning leaf and scraps for the fillers of cigars.
7th. Any kind of leaf having exceptional fragrance, with little strength and no pungency. The demand for this class of tobacco is not very great, but it has never yet been fully supplied, consequently prices are very high, as much as 12s. per pound has been paid for a really fine parcel, and the ruling price for some years past has been 7s. to 8s.

All tobacco for European markets must be properly and well cured, sorted, and graded. Each package must contain only one quality, one colour, one size of leaf; torn, broken, blistered, or discoloured leaf must be put up in separate packages. There must be no nesting, or even suspicion of false grading. The whole must be well packed and firmly pressed, and, with the exception of classes 4 and 7, must not contain more than 17 per cent. of moisture.

The only particulars in which the tobacco grown in this district fulfil any of these requirements are colour, body, and flavour. Its colour is satisfactory, it is tough enough, and, though not exactly the same, its flavour is quite equal to all but the very highest grades of American.

The curing is very imperfect, sorting and grading is not done, blotches and discolourations are far too frequent in every bale, every hand contains torn and holey leaves, the leaf itself is too narrow, and has a mid-rib out of proportion to the width of leaf it carries. To sum up in a few words, all that depends upon nature is very good, what depends on art is all at fault.

There is no reason why, with the application of the needful skill and the necessary amount of labour, the tobacco producible in this district should not take at least as high a place in the English markets as American does.

American planters have for 300 years or thereabouts devoted all their energies, skill, and capital to the improvement of their tobacco, and have taken possession of the world's markets. We cannot expect to jump into their places at a bound. It is first necessary that we should find out which of the many varieties of tobacco in cultivation finds the most congenial conditions in our soil and climate. This can best be done by each grower in each district making experimental plantings of half an acre of each of two or three varieties and carefully noting their peculiarities. These experimental crops should be carefully and skilfully cured out, sorted, graded, and properly packed. They should be sent to London, and the tobacco trade section of the London Chamber of Commerce should be asked to report upon them,

after which they should be sold either by tender or by public auction at one of the periodical tobacco sales. The result of the sale would determine the relative value of the various crops, and our growers would be guided in their future plantings by the information thus acquired. By these means an export trade would be opened, and glutted local markets become a thing of the past.

We have dealt thus far with over supply and consequent low price of leaf, and have indicated improvement of quality and export of the surplus as the surest remedies. But low prices have not deterred planters. Even with 3d. per lb. as the nominal price, and large stocks of old tobacco on hand, a grower at Oberne planted 19 acres this year. Another planter says that at 4d. per lb. tobacco is the most profitable crop he can raise. Some other cause than low prices, therefore, exists to account for the numerous abandoned cultivations and scores of ruined and dismantled sheds which line the valleys of the Tumut River, the Hillas and the Oberne Creeks. This is to be found in the more than partial failure, in the last three years, of the crop, from a disease variously known as blight, mildew, bluemould, or rust. This fungus, *Peronospora hyocyami*, is described by Dr. Cobb as "threatening to extinguish the culture of tobacco in certain parts of the Colony, appearing as a powder or mildew on the leaves, particularly on the underside of the leaves, and especially on the young plants."

We find that in some seed-beds this pest has shown itself almost as soon as the seedlings were well out of the ground; in others it has not appeared until they were almost ready for planting out; in every case the disease first appears on the under side of the leaves, nearest the ground, in certain conditions of the atmosphere, especially after thunderstorms; its career is rapid in the extreme, three days sufficing to render a promising seed-bed a mere mass of scorched and withering leaves. The fungus covering the leaves, their stomata become choked, the plant sickens, its pith loses its healthy, clear colour, the roots soften, and rapid decay ensues. In some cases the disease has not been noticed in the seed-beds, but has shown itself after planting out. It has not always attacked the whole area planted—in the midst of diseased fields patches here and there have remained healthy.

It is said that this disease was not known in the district until 1890, but we have seen unmistakeable evidence of its presence in a bale of tobacco of the 1889 crop.

As this fungus always appears first on the under side of the lowest leaves on a plant, it is a fair inference that it exists, or its spores exist, in the earth, only awaiting favouring conditions for its development. These conditions are a moist atmosphere, dull, thundery weather, hot days, and cold nights. Dr. Cobb suggests the following experiments for its extirpation, and as the Bordeaux mixture has proved effectual in the case of the potato blight, which is very closely allied to it, we strongly urge a fair trial of the treatment:—

"Tobacco Mildew.

"This disease, which threatens to extinguish the culture of tobacco in certain parts of this Colony, appears in the form of a powder or mildew on the leaves, particularly on the under side, and especially on the young plants. It is caused by what appears to be the fungus known as *Peronospora hyocyami*, De Bary, a fungus closely allied to that causing the potato blight or potato murrain. The disease is doubtless, in this part of the world, one of the most serious plagues of the tobacco grower, being especially destructive to young plants.

"*Directions for experiments.*

"Although there is a possibility that the disease may not appear during the present season, yet it is considered advisable that experiments be commenced and carried out in the anticipation that it will appear again. The field experimented upon should be divided accordingly into the parts treated with fungicides and the parts not treated. Each plot should, however, be in other particulars as nearly as possible identical, that is, as to the nature of the soil, system of cultivation, &c. Four separate plots are recommended to be treated—(1) with Bordeaux mixture only; (2) with ammonio-carbonate

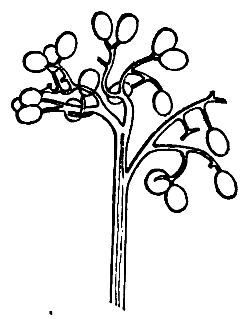


Fig. 2.—The Tobacco Mildew, *Peronospora hyocyami*, De Bary (x 200). The pale, rather thick, erect, non-septate fertile threads of the tobacco mildew rise to a height of 300μ, being, above the middle, four to eight times dichotomously branched,—thus forming a panicle, whose divisions are alternate, and more or less curved, and whose short widely-divaricate ultimate branchlets bear pale violet ellipsoidal spores, measuring 13—15 x 18—24μ.

of copper only; (3) with *eau céleste* only; and (4) with nothing. The formulæ for making preparations (2) and (3) are given below. Each of these mixtures is to be applied as soon as the plants appear above ground, and once in every ten to fourteen days throughout the season of the year when the mildew is destructive.

"A hand or knapsack spraying machine is recommended in the case of tobacco cultivation in our districts, as the machine will be simple and handy for the Chinamen to use. Such a machine should have a single nozzle, which throws the spray sideways instead of straight forward, so as to enable the under as well as the upper sides of the leaves to be sprayed. A hand machine with a suitable nozzle, named the 'Cyclone,' may be obtained from various hardware dealers; but it is uncertain whether a knapsack machine can at present be purchased in the Colony, although the Department is encouraging the introduction from France of the Vermorel knapsack sprayer, which is illustrated and described in Mr. Despeissis' article in Vol. II, Pt. 10, of the *Agricultural Gazette*.

"It is of the greatest importance that a complete diary be kept of all the facts connected with the experiments, especially with regard to (1) the nature of the soil, its preparations, &c.; (2) the kind of fungicides employed; (3) when the fungicides were applied; (4) the condition of the plants when applied; (5) the state of the weather before and after each application; (6) when the disease appeared, and under what circumstances.

Ammonio-Carbonate of Copper.

a Dissolve 2 lb. of copper sulphate (bluestone) in hot water.
b Dissolve 2½ lb. of sodium carbonate in another vessel of water.

Mix (*a*) and (*b*) and before using, add 1½ pints of ammonia, and then dilute to 30 gallons with water.

Eau Céleste.

Copper sulphate	1 lb.
Ammonia (strong)	1½ pint.
Water	22 gallons.

Dissolve the bluestone in a gallon of the water, add the ammonia, then the rest of the water.

"If the weed known as henbane (*Hyocyamus niger*) occurs in or near the tobacco plantation, pains should be taken to destroy it, as it harbors the fungus here described. I am told by Mr. Turner that this weed is abundant in some parts of this country."

We are of opinion that its prevalence and rapid spread are due to causes quite within the power of rational cultivation to modify, if not wholly to control.

The seed-beds are usually made on the flats, which, in ordinary spring weather, are covered, soon after sunset, with a shroud of vapour, which is not dispersed until the morning sun is well up in the sky. On the higher lands this mist does not lie; the conditions, therefore are less favourable to the growth of fungi. In Java the seed-beds are made in sheltered spots amongst the hills, and the plants are brought, often long distances, down to the plains to be planted. This plan might be adopted here with great advantage.

Let the site chosen for the seed-beds be above the reach of the night fogs, in light sandy soil, with a north-easterly aspect. Let the ground be roughly dug in the autumn, a spade and a half deep, and left exposed to sun, air, and rain. Let it be dug again in the winter, and exposed to whatever frost may come to sweeten it. Let it be dug a third time in early spring, and then pile upon it all the trash, brushwood and branches available 3 or 4 feet high, and burn it. When cool, rake off unburnt ends and charcoal, and dig in the ashes not deeper than 3 to 4 inches, with a liberal dressing of well-rotted sheep, goat, or poultry manure; water plentifully. When sufficiently soaked in, rake very fine, keeping the surface of the bed quite level, and raised some 4 inches above the surrounding soil, or else make a trench on both sides of the bed about 6 inches deep. Mix the seed in the proportion of half an ounce to a bucketful of fine dry earth, and sow thinly.

For shelter, put forks into the ground at convenient distances, standing about 8 inches out of the ground on the south side, and 4 inches on the north. On these forks rest saplings, to carry the screens. These screens may be of calico or hessian, nailed on frames, but grass hurdles, made a little wider than the seed-bed, and of any convenient length, are both cheaper and better. For the spring sowings, grass hurdle screens afford full protection against late frosts, and for later sowings make an excellent shade from the heat of the midday sun, and a protection from heavy rains or hail-storms. They are to be higher on one side than the other, to prevent drip

in wet weather falling on the plants beneath. These screens are light and easy to handle. They allow a free circulation of air and light amongst the seedlings. Should the plants come up too thickly, they positively must be thinned out to ensure strong plants. Those removed may be pricked out into a nursery-bed an inch or an inch and a half apart. In watering the seed-beds, care must be taken not to deluge them. Give them enough, but not too much, water, and always with a fine rose on the watering-pot.

It will rarely occur that seed-beds thus carefully prepared, protected, and treated, will ever suffer from any fungus. The enrichment of the seed-bed with well-rotted manure may, by some, be considered needless, but experience teaches that a seed-bed cannot be too rich. Quickly-grown, vigorous plants are less liable to, and better able to resist, the attacks of fungus and insect enemies than feeble, struggling seedlings, and when transplanted they make new roots more readily. It is even advisable to lightly sprinkle the seed-beds with liquid manure every day for a week before planting out.

If, however, in spite of the best treatment, the mildew should appear, spraying with one or other of the fungicides suggested by Dr. Cobb should be resorted to immediately, or, if the appliances for spraying are not at hand, every affected plant should be pulled up and burnt at once, to prevent the spread of the disease. Sprinkling is of very little benefit, as the disease is on the lower side of the leaves, and sprinkling only affects the upper surfaces.

It may be said that all this elaborate preparation and care involves the employment of a large amount of labour which costs money. No doubt it does, but it brings money's worth back many times over; the extra cost is a good paying investment.

Besides the *Peronospora*, there are other enemies which attack the seed-beds, and amongst them are the small boring grubs of which *Lita solanella* may be taken as a type; we say as a type, because we have seen several of these grubs very much resembling each other, but not identical in their habits. We have not yet had an opportunity of seeing any infested crop treated by spraying. We have seen amongst the tobacco plants a small maize-coloured moth, a smaller pale blue moth, and some flies and beetles. What particular form of damage each of these does, and what are their proper entomological names we have not yet had any opportunity to verify. It is obvious that the life history of each requires to be known before any really effective means of dealing with them can be devised.

The cut worm, so sadly well known in the American plantations, has a representative here which is somewhat smaller than its American cousin, and makes its hole in the stem of the plant just below instead of just above the surface of the soil. The caterpillar of the sphynx moth (*Sphinx quinque maculatus*), known in the States as the tobacco worm, we have not yet seen here, but a green caterpillar having similar habits, and doing as much mischief, is common. So far as we know there are no known means of combating these and the grasshoppers other than by the capture by hand of the individuals. They are easy to find, and it is in this work that children may be employed to advantage for an hour or so in the early morning and towards sunset. Poultry will also assist in this work. It has to be done if a marketable crop is to be harvested, and every aid is to be welcomed in the tedious task. We hope to be able to illustrate shortly some of the means by which the parent moths of these grubs can be prevented from depositing their eggs on the tobacco plants.

The grubs and other insect enemies of the plant are known in other tobacco-growing countries, but are kept in check by the vigilance and industry of the planters.

A long continuance of negligent farming has doubtless been one of the causes of the great prevalence and rapid spread of tobacco pests in these districts, and any amelioration must be looked for in the employment of better methods.

The constant repetition of the same crop on the same ground gathers around that crop all its enemies in constantly increasing numbers, besides exhausting the supplies of the particular kind of plant food which that crop requires. Alternation or rotation is desirable for all crops, and for tobacco it is absolutely indispensable. The Sumatra planters have made the greatest profits on record; they only plant tobacco on the same fields once in five years, giving the land four years' absolute rest. There is ample space in this district to do the same, there being at least 15,000 acres of good tobacco land in the three valleys.

In all the districts west of Tumut the rainfall is much lighter than in that valley; in fact, there had been no rain at Hellas Creek and Oberne in the three months prior to our visit, yet the creeks were not dry, and in all the places where tobacco is grown there is a plentiful supply of water available for irrigation purposes at a depth of from 6 feet to 12 feet below the surface.

The thorough aëration of the soil by autumn and winter ploughing of the fields in which it is intended to plant tobacco is also necessary to the production of a fine crop. Plant food in abundance may be in the soil, and yet the plants be starved unless by efficient ploughing and harrowing it is reduced from its naturally compact state to a free and open texture which the rootlets can penetrate in search of nutriment. The action of sunshine, air, rain, and frost is needed to bring the elements of plant food into a condition in which the plant can readily assimilate them, and beyond this, as the grasshopper tribes pass their infancy under the soil, frequent ploughings and harrowings bring them to the surface, where their natural enemies capture them or exposure kills them. Thorough cultivation pays well in the long run.

We have been sorry to see diseased leaves and plants lying about between the rows as though it was desired to propagate and establish the disease as far as possible. It cannot be too often repeated that every diseased leaf and every diseased plant should be removed from the field and destroyed by fire, to plough them under or to rot them for manure is to invite disaster, and to court the very plagues we lament.

We have found on every hand a hearty appreciation of the action of the Department in trying to save the tobacco industry from extinction, and an earnest desire to co-operate in effecting the necessary improvements both by sowing new varieties of seed by the adoption of better methods and by the construction of efficient drying and curing houses. The desire has been generally expressed that the Department should secure supplies of reliable seed and appoint an expert to reside in the district for at least one season to advise and instruct the growers, and to give the much-needed help in preparing their crops for exportation.

REPORT on sample leaf (about 2 lb.) from the same parcel from which 1-cwt. bale was sent to the World's Show at Chicago.

Variety.—Heavy low-growing Kentucky, not easily recognised, having been grown from its own seed many years.
Form.—Long narrow-pointed leaf, with heavy midrib and veins.
Colour.—Rich red, fairly uniform.
Length.—Fully up to every requirement.
Texture.—Good.
Condition.—Somewhat torn, from careless handling; not much insect injury.
Flavour.—Very good, but exceedingly strong.
Curing.—Very imperfect, showing discolourations from being too close hung when seaf-folded in field; blotches green from sunburn, some house-burn, much stem muold.
Disease.—No traces visible.

REPORT on sample leaf (about $1\frac{1}{2}$ lb.), 4 years old, supplied by Dr. Mason.

Variety.—Similar to above.
Form.— do.
Colour.—Uniform light red, might be classed as medium semi-bright.
Length.—Fairly merchantable.
Texture.—Good firm leaf.
Condition.—Very ragged from worm and grasshopper holes, partly, also, from careless handling, also, probably, from high wind in shed.
Flavour.—Very aromatic, remarkably so, seeing that it had been exposed to every atmospheric change for upwards of three years.
Curing.—Fairly good, one leaf only showing stem mould.
Disease.—One leaf shows traces of *peronospora hyocyami.*

Tobacco Growing in New South Wales.

By S. LAMB.
Department of Agriculture.

UNTIL a few years ago the growing of tobacco was a very profitable branch of the farmer's business in many parts of this Colony; very fair tobacco was grown, and very good prices were paid for it, but now tobacco-leaf is not salable at a price that will leave any margin of profit to the grower; even the Chinamen are getting tired of it, and there are considerable stocks of old leaf still in the hands of growers and storekeepers in the country, while the Sydney market is glutted.

Several causes have combined to bring about this unsatisfactory state of things, the principal and immediate cause being the exceedingly large quantity of leaf produced in the years 1889 and 1890, which enabled manufacturers to lay in stocks sufficient for all their needs for a considerable time to come.

The low prices now current have, however, had the effect of reducing the area planted, and the diseases which have attacked the plants in several districts, have greatly reduced the yield, so that some advance in the price may be looked for next year. A run of high prices has always induced large plantings. Heavy crops have always been followed by low prices, and this will continue so long as colonial-grown tobacco is of such a kind and quality that it can only be sold within the Colony. When better sorts of tobacco are grown, and better methods of cultivation, harvesting, and curing are adopted, the surplus of a good year can be exported to Europe; indeed, it would be wise to grow tobacco, especially for the European markets, and leave the Colonial market out of consideration altogether. The total consumption of New South Wales is not quite 3,000,000 lb. a year, while the consumption of the United Kingdom is over 60,000,000 lb. yearly. A small market is easily glutted, a large one cannot readily be over-supplied. If the right sort of tobacco was grown, and it was properly cured and packed, there would always be a ready sale in London for all that New South Wales could grow at prices ranging from 7d. to 15d. per lb. according to its texture, colour, flavour, and condition.

That really fine tobacco can be grown in New South Wales is undoubted. It is a rare thing to open a bale of Colonial leaf that does not contain a few leaves of really choice quality, although grown from the common seed usually sown. It is not yet known what the best seed, grown under the most favourable conditions, in the best soil to be found in New South Wales, would produce, because no one has yet tried it. It is quite possible there may be a surprise in store. It would be an experiment well worth trying. It costs no more labour to plant the best tobacco than the worst; the cost of proper cultivation and curing are not much greater; the most costly item is a proper curing-shed that can be closed when necessary to shut out

unfavourable weather, with flues to maintain the atmosphere inside at the right temperature during the second or drying stage of the process. The outlays for this purpose would undoubtedly be recouped by the extra price obtained for the first crop.

A writer in one of the newspapers a little while since said that tobacco cultivation in Australia could never be a great success, because Havana tobacco could not be successfully grown outside the Island of Cuba, and Virginia tobacco could not be grown except in the United States. He might have gone a great deal further, and still have been both right and wrong, right in his facts, and wrong in his conclusions. The Havana tobacco that is universally esteemed, and that has won the world wide reputation of Havana cigars cannot be grown outside the Island of Cuba, nor even in that island, except in one little district known as the Vuelta Abajo or Happy Valley. It is not quite 27 miles long, and not more than fourteen at its widest part; and even in that limited space there are patches that will not grow fine tobacco; the very finest is grown at a place called Arroyo Hondo, and is worth about 16s. per lb. in the bale. The fact that only one little place in the whole world has produced such tobacco is no argument that Australia cannot produce anything worth more than 4d. per lb. It has not prevented Mexico from growing tobacco from Havana seeds, and getting 3s. per lb. for it.

Again the writer said that Virginia could not be grown elsewhere than in America; he might as well have been more precise and said that it could not be grown outside Virginia, neither in Kentucky, Maryland, Carolina, Ohio, nor Missouri, and yet all these States produce good tobacco, and North Carolina tobacco is more highly esteemed than Virginian.

Every country produces its own characteristic tobacco, and every district has its own pecularities, even in this Colony the differences are already very marked. Tamworth tobacco is different from Tumut tobacco, though grown from the same seed, and places much nearer to each other than those two towns are, produce leaf with special characteristics.

When experiments shall have been made and experience proved which sorts of tobacco thrive best in each locality, New South Wales will have many grades of tobacco, all good and some very good; and an export trade will be established which will support in plenty and comfort a very much larger population than are now vainly seeking a means of subsistence.

In the hope that some of our more progressive farmers will make an effort to revive tobacco cultivation on the basis of quality rather than weight, the Department of Agriculture is obtaining seed of the best kinds, which will be supplied in quantities sufficient for trial plantings to all who will undertake the experiment.

The *Agricultural Gazette* will contain month by month directions as to the best methods of cultivating, harvesting, and curing the crop.

Reminders.

Land intended for tobacco cultivation should now receive its first preparation by ploughing not less than 8 inches deep.

In selecting land for tobacco several things have to be considered; first, the nature of the soil—it should be a rich, free, friable sandy loam, containing a fair proportion of decayed vegetable matter (humus). Heavy black soil flats produce the biggest plants, and the greatest weight per acre, but the tobacco is coarse and rank, with thick mid-ribs and veins. It is neither fine flavoured nor priceworthy. It does not need much knowledge of figures

to prove that a crop of 1,400 or 1,500 lb. of leaf that will bring 9d. per lb. is better for the grower than a crop of 2,000, that will not sell for more than 4d. per lb. Red or chocolate soils produce a good flavoured tobacco. Light grey soils do not often yield either good flavoured or good burning tobacco, but there are exceptions; clayey soils, and those that cake and crack in dry weather are not good.

Situation is of great importance. The land should be sheltered from high winds, which batter and bruise the leaves. In open country, where there is no shelter, it is desirable to plant rows of corn, teosinte, sorghum, or millet at intervals, to break the force of the wind. It is not wise to plant tobacco where hailstorms are frequent, nor where it is subject to floods. Even only a few inches of floodwater standing in a tobacco-field for twenty-four hours will ruin the crop. There should be water at hand, in case a dry time should happen to come just after planting out, as the plants require moisture for two or three weeks until they are established and have got a start, but once established, they can stand drought better than any other crop that grows. In this Colony at least, the universal testimony of growers is that tobacco always succeeds best in dry seasons.

If the land has not a good natural drainage it will pay well to drain it. Well drained well cultivated soil is always moist and warm, and it is surprising what rapid growth and early maturity tobacco shows when it has these advantages.

Do not attempt to grow tobacco on soil that has been planted with that crop within the last three years. Once in four years pays best. The grubs that injure tobacco can only find subsistence on tobacco and potatoes. If they cannot find these they die, therefore let a grain crop follow tobacco, and so escape many enemies and diseases of the plant, and keep the land in good heart.

If you have manure it will be well to spread it on the surface and plough it under. Well rotted sheep dung is the best; farm-yard and stable manure next. A top dressing of lime is always useful, either now or at the second ploughing.

Tobacco as a Farmers' Crop for New South Wales.

By G. F. SUTHERLAND,
Department of Agriculture.

The successful culture of this crop for a period of more than sixty years in various parts of the Colony has very fairly demonstrated that a number of the many varieties known to commerce have found a congenial home within our boundaries. Some of them, under the favourable circumstances necessary to their proper development, have commanded the esteem of connoisseurs, and gone some way towards demonstrating the possibility of a successful prosecution of the industry among us. While the remainder, owing to error in selection, defective cultivation, or faults of treatment in the preparation of the mature leaf, have brought the product into some discredit.

To the above causes must be ascribed most of the bad characteristics fairly attributable to some New South Wales grown leaf, as it is now found in the Sydney or other markets, but all of which are remediable by a better acquaintance with the character and requirements of the plant in its various stages of growth and preparation for market. I will endeavour in some measure to impart in the course of this article, information which will be of service in removing these difficulties.

The pessimism that denies the capacity of this Colony to produce good aromatic tobacco has no excuse in fact, the contrary being well established, and may be allowed to pass without any remark, other than that it is explainable by the same prejudice, which, in human affairs, discredits a prophet in his own country.

The wide variety of soil and climate within our borders permits of the growth of the three kinds of tobacco known in the trade as pipe, cigarette, and cigar leaf, the favourite brands of which are chiefly the products of different countries and latitudes, and in the case of the latter article, demands well defined characteristics all its own.

Although our geographical position does not permit of growing a cigar leaf that would compete with the product of the Vuelta-Abajo, whence the finest Havana tobacco is derived, still, land bordering the estuaries of our North East Coast Rivers ought, and with the application of proper means, will supply a naturally good class of cigar leaf, profitable to the grower, and agreeable to the manufacturer. While the eastern slopes of the dividing range north of the Hunter River afford a corresponding latitude and soil to portions of the Levant, whose tobaccos command fabulously high prices for the manufacture of cigarettes.

The rich and fertile valleys of the Tamworth and Tumut districts, which are typical of thousands of acres of similar land in the interior of the Colony, have for many years been the home of a successful tobacco growing industry,

whose produce in the future, under more skilful treatment, I am ambitious enough to hope may vie with that of America for the esteem of the pipe smoker. This latter trade has recently suffered from the ravages of a fungoid disease and low prices, both causes which we hope soon to see remedied or removed by the skill, industry, and capital of the farmers concerned. I would direct attention to the fact that European countries import not less than 300,000,000 lb. of this commodity every year, of which amount Great Britain alone consumes 60,000,000 lb.

As New South Wales already caters for the Englishman's breakfast and dinner table in the shape of plentiful and much appreciated supplies of butter, beef, and mutton, it would be no extraordinary departure from its functions as a universal provider to add tobacco to the list. This is well within its means if growers will proceed upon the lines hereafter respectfully laid down for their consideration and guidance under the various headings of selection, cultivation, and curing. This is the more necessary, as the local market is only a very limited one, and easily overstocked. Although the present article is primarily intended to deal with the *technique* of the industry, it may not be out of place to point out what position and estimation the local product commands within the Colony, and what are the drawbacks to its healthy development, some information regarding which may most clearly be furnished by the following tabulated statements compiled from the *Statistical Register* for 1892.

TABLE A.

TOBACCO Production of New South Wales.

Years.	Area.	Out-turn.	Average.
	acres.	lb.	
1888	2,371	2,628,080	1,167 lb. During 1890, 1891, 1892, severe disease prevailed.
1889	4,833	6,213,536	
1890	3,239	3,005,088	
1891	1,148	1,570,352	
1892	886	1,043,168	

TABLE B.

Years.	Total consumption.	Colonial leaf (New South Wales) paid excise duty.	Imported leaf used.	Manufactured in New South Wales and paid excise duty.	Manufactured tobacco imported.
	lb.	lb.	lb.	lb.	lb.
1888	2,610,124	1,451,898	610,480	2,062,378	594,746
1889	2,697,252	1,425,652	545,740	1,971,392	715,760
1890	2,680,125	1,323,172	569,420	1,892,592	787,533
1891	2,831,098	1,343,852	639,140	1,982,992	938,106
1892	2,975,076	1,352,154	612,475	1,964,629	1,010,447

From these tables the intelligent farmer may glean that last year he only supplied 1,352,154 lb. or 44 per cent. of his Colony's requirement against 1,451,898 lb. or 56 per cent. five years previously, while what may be accepted as the ordinary capacity of the country's production as exhibited by the 1889 crop, totalled over 6,000,000 lb. This having been prepared for market under the primitive and inefficient conditions prevailing generally in New

South Wales was quite unsuitable for a foreign trade, thus requiring several years for its absorption locally, which under the more favourable circumstances of treatment obtaining in America and elsewhere would have at once made it a readily saleable commodity either at home or abroad.

The result of growing three years requirements in one year, and having no outlet for the surplus in the shape of an export trade, produced the natural result—a fall in prices—and as production has been going on every year since on the old lines, whilst consumption has even decreased, stagnation and low values still continue. I therefore think it is time for the farmer to consider one of two alternatives—either to cease producing or to grow for an ever open market with well-defined wants. The latter course, there are reasonable grounds to believe, would prove largely to his advantage. As to the inherent good qualities of several growths of New South Wales tobaccos we have satisfactory proof in the frequent and favourably-expressed opinions of leading local and British manufacturers, with numerous brokers' reports, a *précis* of one of which I append. All of these have been unanimous in praising the texture and aromatic character of the samples submitted to them, although unfavourably criticising its *handling* and *absence of classification*, which are faults that have also been repeatedly animadverted upon by Sydney brokers (*vide* daily Press). These points are as important as quality in the determination of price. While upon the subject of export, which I hold to be the best means of reviving the tobacco-growing industry and placing it upon a stable footing, I would endeavour to remove some misconceptions that prevail upon the subjects of cheap labour in the tobacco producing states of America as compared with New South Wales. Also the proportionate dearness of sea-freights for our produce—both serious obstacles the farmer here thinks to any chance of competition with his American cousin. The latter item alone is against us, but not to a very important extent, as tobacco may be sent from either Gundagai or Tamworth to London for about £3 10s. per ton, or, including minor charges of insurance, brokerage, and dock fees, about ½d. per lb. In the matter of wages of the agricultural labourer almost the same rates prevail in America as do here, viz., 1 dollar per day and food, and the negro as much as the white man. The cost of production is, however, kept down in America by the sensible custom of a farmer generally confining the area of his tobacco-field to what can be properly cultivated and tended by his own family, the members of which, from 4 years of age and upwards, give useful assistance in raising this profitable crop, and this is what he produces per acre :—

In Connecticut, 1,600 lbs.; Pensylvania, 1,600 lbs.; New Hampshire, 1,600; Massachusetts, 1,350 lb., or an average of 1,537 lb. per acre, while

	Per acre.		Per acre.
Kentucky averages ...	630 lb.	Texas averages ...	650 lb.
Virginia ,, ...	630 ,,	New York ,, ...	800 ,,
Missouri ,, ...	850 ,,	Georgia ,, ...	550 ,,
Maryland ,, ...	675 ,,	Florida ,, ...	750 ,,
W. Virginia ,, ...	680 ,,	Mississippi ,, ...	317 ,,
N. Carolina ,, ...	500 ,,	Alabama ,, ...	465 ,,
Tennessee ,, ...	675 ,,	Arkansas ,, ...	822 ,,
Ohio ,, ...	700 ,,	Wisconsin ,, ...	500 ,,
Indiana ,, ...	500 ,,	Kansas ,, ...	670 ,,
Illinois ,, ...	550 ,,		

or a net average of 627 lbs. for the other nineteen tobacco growing states of the Union. The generosity of both soil and climate in this Colony is so

great that 1,200 and 1,300 lbs. is considered a moderate crop, and in many cases may be taken off the same soil year after year without any appreciable decrease in yield. Although I do not recommend this custom—rather the reverse—it will be seen that a fair equality of circumstances exists between us which should give our farmers courage to make a trial of the export business.

Tobacco-growing and its concomitant operations—curing, sorting, and packing, having been established industries in the United States of America for quite 250 years; all new communities adopting the cultivation of this plant have wisely directed their attention, and more or less closely adhered to the systems in use in its preparation in that country. These, of course, will be varied by the requirements of local conditions, but it will be by the fidelity with which the practice of that exceptionally intelligent people is followed (I will not say slavishly copied) that the New South Wales farmer may hope to attain the maximum of success in his venture. A thorough knowledge of tobacco-growing and curing, like shoemaking, is only to be acquired by much practice. Each class of tobacco has its own characteristics and requires special treatment, especially in the latter process. But the experimenter will, by paying careful attention to and complying with the succeeding instructions, get wonderfully close to a correct result.

Botanists furnish us with the names of many different species of this interesting order of plants, an account of which and their numerous subdivisions and varieties, although pleasing to the curious mind, would be beside the scope of this article, in which I will only refer to those providing the principal tobaccos of commerce.

1. *Nicotiana tabacum* (*macrophylla*), better known as Maryland tobacco with its stalked and stalkless subvarieties, to the latter of which belong *Nicotiana macrophylla ovata* and *N. m. latifolia*, short and long leaved Maryland, and *N. m. pandurata*, a broad-leaved, hardy, and profitable plant. All of these provide good smoking tobaccos, either for pipe or cigar, according to the locality of their growth. The stalked varieties are *N. macrophylla cordata* and *N. m. alata*, the supposed progenitors of Cuban and Manilla tobaccos. The botanical characteristics of most of this species when carefully grown are a large, thin, elastic leaf, of silky texture, with fine midrib and veins, which render them great favourites with the cigar manufacturer, and when to this is added a delicate aroma, they may be said to possess all the merits that distinguish the very finest grade of tobacco.

2. *N. tabacum* (*angustifolia*), Virginian tobacco, also divided into petiolate and sessile subvarieties, produces generally a heavier, coarser, and more strongly flavoured tobacco than the Maryland. Its numerous varieties, which need not be detailed, are, however, the most generally cultivated of the tobacco family in the temperate zones, for which they are probably better adapted than any other. Most of the plug, spinning, and cutting tobaccos grown in America, Europe, or elsewhere are from this species.

3. *N. Rustica*—Hungarian or Turkish S., which provides most of the tobacco grown in South Eastern Europe. There are two kinds, *N. rustica cordata*, with large heart-shaped leaves, of good flavour, and *N. r. ovata*, small leaved, very aromatic, Turkish tobacco. The former is a heavy cropper and the latter a light one. The above list embraces all the best known tobaccos of the world, each of which have their respective merits, and may be more or less successfully cultivated in one or other district of this Colony. They are however, better known to the farmer under less scientific names, some of which I will attempt to supply.

The "Maryland" variety provides the favourably known Amersfurt, Dutten, and broad Dutch tobaccos in Europe, with Ohio, Cuban, Connecticut, Manilla, Havana, and their numerous local classes in both hemispheres.

Of Virginian varieties, so called, the list is endless, the best known being big and little Frederick, Oronoko, and Kentucky, which are mostly heavy producers, white Burley, and yellow Pryor, when grown on suitable soils, cure a good bright or golden colour, while Brittle-stem is favourably known for its early maturity. Turkish tobaccos of the kinds worth introducing into New South Wales are all light croppers. Those most favourably known are Latakia, Dubec, Cavalla, and Yenidjeh. Although the common brands of pipe, cigarette, and cigar tobaccos are, by the chemical skill of the manufacturer, produced from every and any variety of the plant, still, the largest quantity, and particularly the finer kinds of each class, are prepared from the distinct growths of certain countries whose qualities of texture, aroma, &c., adapt them to their respective forms of manufacture in which they have gained the popular taste, always a very conservative one in the matter of tobacco.

Pipe Tobaccos.

A term which explains itself, are the product of any variety, but chiefly of Virginian, grown on deep, rich, alluvial, or loamy soils, containing a high percentage of humus and inorganic matter, such as lime, potash, &c., in a readily accessible form. They do not require proximity to the sea for their successful production, and demand a moderately high temperature. A varying, but not heavy rainfall, particularly in the early period of their growth. May be raised by irrigation, but generally at the cost of quality and texture, and are principally and most successfully cultivated within the limits of the 25th and 45th parallels of north and south latitudes, thus pointing out the whole of our Colony, where suitable land exists, as a field for the production of these tobaccos.

Cigar Tobaccos

Of a high class are exclusively the product of the tropics, and then only in limited areas can be found that happy combination of circumstances necessary to its perfect production. The requirements are a rich soil, in perfect physical condition, a high temperature, modified by proximity to the sea, and a humid atmosphere. Cuba, Sumatra, and the Philippines are the most celebrated producers, and the greater the similarity of any locality to these countries in the foregoing necessary conditions will also be its chance of producing a good cigar tobacco. As previously suggested, the banks of our northern rivers are most approximate to the above requirements, and if efforts fail to quite realise the high standard aimed at, the result should still be a very profitable one, as prices for this class of tobacco mostly range high.

Cigarette Tobaccos.

The chief favourites in this class are solely the product of the Levant and the countries bordering thereon. They are grown from a number of local varieties of Turkish tobacco, the names of some of which I have furnished. Their leaves are kept small by the system of close planting practised, which will similarly affect any variety, and is also credited with influencing the aroma. This latter, however, I take leave to doubt. These tobaccos might be successfully acclimatised in the higher lands of the coast districts of New South Wales, with considerable chance of their retaining

some of their valuable characteristics. The pick of American bright (golden leaf) tobaccos are also used for this purpose, but do not command either the admiration or the price of the Turkish article.

Although Hamburgh, Bremen, Amsterdam, and many other continental towns are all eager and extensive purchasers of good tobacco, the present ruling market rates of London, Liverpool, and Bristol will afford the New South Wales farmer a more correct notion of what price he may expect to obtain for his produce, which would, of course, be subject to the deduction of export charges, approximately stated to be about a half-penny per lb. The sales are effected in bond, and the duty of 3s. 2d. per lb. is, therefore, not a subject that interests the shipper. Prices are, for:—

	s.	d.		s.	d.
American dark leaf...	0	4	to	0	10
Do dark strips	0	6	„	1	0
Do bright leaf	0	7	„	1	3
Do bright strips	1	0	„	...	
Do bright, special parcels	1	6	„	...	
Havana and Cuban...	1	2	„	6	0
Do do special parcels...	...		„	15	0
Manilla	0	8	„	4	0
Sumatra and Borneo	1	6	„	3	6
Turkish—Basma	0	9	„	1	0
Trebizonde	...		„	1	3
Yenitje	...		„	5	0
Dubec	...		„	7	6
Cavalla	2	0	„	5	0

A daily-increasing proportion of the tobacco requirements of Great Britain are received in the form of strips, and command a proportionately high price. They are prepared by extracting two-thirds or three-fourths of the stem or midrib of each leaf, an easy, although, may be, tedious, operation, to be described later on.

Soil.

Such labour, expense, and precautions as are afterwards recommended for the proper growth and preparation of this crop may appear superfluous to farmers whose previous practice, owing to the peculiar richness of the soil and mildness of the climate, have consisted in ignoring some of its most common requirements. But the careful farmer will, I hope, think otherwise, and see the necessity of following the given advice in its entirety. In the case of faults of curing, they may, in most instances be justly ascribed to insufficient skill or knowledge of the correct methods of treatment, which, in spite of the years the industry has existed in the Colony, are but very partially understood or practised by the growers. This preamble is not intended to be offensive or discouraging, but to accentuate the counsel, which experience will show to be a truism in tobacco farming, viz., that every operation, from the preparation of the first seed-bed to the despatch of the last barrel or box of cured leaf to market, demands ceaseless care, attention, and application for the proper execution of the multiform processes, which it is necessary for it to pass through, and that unless the cultivator is prepared to bestow the same upon it, he cannot expect such favourable results as would otherwise accrue to him. It is, however, only fair to mention that, in return for the labour and care expended on this crop, the reward in pounds, shillings, and pence is proportionately great, and such as no other crop will concede.

Although large areas of suitable land exist in contiguity, local circumstances render it improbable that tobacco-growing on the "plantation" scale and system will ever be adopted among us, nor is it necessary for the successful development of the industry that it should. Indeed, tobacco is peculiarly a small farmer's crop, there being few who do not possess a little area of suitable land, 1 or more acres of which could profitably take its annual turn at raising it, and thus furnish its quota towards the programme of a "mixed farm," which is wisely recommended by all authorities on Australian agriculture as the best means of obtaining an adequate livelihood by the farmer of the future.

As the climate offers no impediment to its cultivation, we are next required to consider the subject of soil, these two being the principal factors in its production which determine the quality of tobacco. The rich alluvial flats adjoining the large rivers of the interior and their tributaries, composed of the deposits of floods and the detritus of the surrounding high lands are rich in the elements of this plant-food, and have been found to produce most luxuriant crops for many successive years without any recuperation in the shape of manure being found necessary. And in those areas where the inundations are annual, with a consequent recovery of the fertile properties of the soil from the sediment deposited, they furnish an exception to the dictum of "liberal manuring" that should otherwise prevail in tobacco culture, as well as affording an excuse for non-adherence to the almost equally important rule of "rotation" in crops. It is in such districts that the industry so far has found a home, and has been most successfully prosecuted, although there is no doubt but that lands of lighter character than the above, especially those whose soils are partially composed of the denudation of granitic ranges, are capable of producing tobacco of a much finer aroma and texture than those grown on the heavier soils.

Land intended for tobacco cultivation should be a deep, rich, friable soil. Dry and warm from good natural or artifical draining. Sheltered and with a north-easterly aspect if possible. Such a position, affording the maximum of sunshine, is an important factor in producing an early as well as a good crop. Cold, wet or tough and clayey soils, and those generally answering to the colonial term of "glue-pot" lands, are quite unsuited for tobacco-growing. This plant above all others, requires a loose soil that may be easily traversed by its tender rootlets, which free condition, depends equally upon its constitution, and the industry of the farmer.

A soil rich in decayed vegetable matter best ensures this necessary friability, as well as affording a large proportion of the food requisite to build up the plant, to complete which must be added a proper proportion of lime, potash, magnesia, phosphoric and sulphuric acids. The two former are taken up by the tobacco plant in large quantities, and are essential to its proper combustion in the manufactured state.

Manuring.

Soils deficient in these properties will, therefore, produce a badly burning leaf, and are to be avoided for tobacco-farming, unless otherwise well suited, when the want may be made good in the form of manure. The art of supplying manure consists in contributing those properties to the soil in which it may be deficient, that it is proposed to extract from it through the medium of any crop. Where this is found necessary in the case of tobacco-farming—sheep, pig-yard, cow-shed, or stable-manure, well rotted, and used separately or all in equal quantities, are proved to be excellent fertilizers.

They should be ploughed into the field two or three months before planting commences, so as to have become thoroughly assimilated with the soil by the time it is called upon to supply the wants of the young plant, which demands readily accessible food in this early and comparatively weak stage of its growth. To the above compost should be added, where available, the well decayed stalks of previous year's tobacco crop. These having extracted from the soil nearly an equal quantity of the same plant constituents as are possessed by the leaf, should never be wasted. I have previously recognised that there are certain self-evident conditions of extraordinary fertility, under which manuring and a rotation of crops, generally so beneficial and requisite, may be temporarily dispensed with. These are, however, only the exceptions which prove the rule, and the farmer who remembers and acts upon the old maxim that "nothing can be taken out of the ground that is not in it," will be best equipped for his profession. The wisdom of growing tobacco in a rotation of crops is universally accepted, as it removes from the soil but little of the plant-food required by many crops in general cultivation, such as maize, barley, wheat and other cereals. Millets, hemp, and pulses are also successfully grown in India, as following crops without the addition of fertilizers. Apart from the needful rest afforded the soil by this desirable change, which should, where at all practicable, be spread over a period of not less than three years, four if possible, there is another and very important result obtained in the destruction or disappearance of the particular enemies of the tobacco plant, such as the cutworm and larvæ of the sphynx moth. These finding their destructive occupation and food both gone, emigrate or die, principally the latter, if there are no other solanaceous plants, such as the potato, tomato, &c., in their vicinity.

The cultivation of these two crops should be avoided in such fields as are proposed to be occupied by tobacco in rotation, as, being of the same family, they feed on similar plant foods, and, in the case of the potato, the exhaustion of the soil is greater than in the case of the plant we are interested in. In addition to the crops above enumerated, the local experience of individual farmers will best guide them as to what others to grow in the proposed rotation.

Where this sensible system of culture may be practised it will be advisable in addition to the special manuring for tobacco, to give a broadcast sowing of three or four bushels of quicklime per acre before the last ploughing. What is even better still, and which will obviate the necessity of equally heavy manuring, is to take four bushels of Colonial Sugar Refining Company's No. 5 manure, prepared as follows: Mix one part manure to three of pulverised dry earth, a handful of which should be placed a few inches below the surface in the space to be occupied by the plant. Peruvian guano may be used the same way, any surplus being profitably applied later on as a liquid manure. Either of these will be found beneficial to succeeding crops as well as to the tobacco, the soils of our Colony being generally deficient in all the constituents recommended.

Green manuring is also a suitable means of recuperating the soil, and may be practised in addition to the use of ordinary fertilisers, with particular advantage in the case of stiff and clayey soils, the physical condition of which are greatly improved thereby. "Sunn" hemp has been used for this purpose by the writer with marked success. It should be allowed to attain a height of not more than 12 in. or 14 in., and then be ploughed into the ground sufficiently in advance of planting-time to permit of its thorough decay. The result is not only an increased friability of the soil, but also a considerable access of nitrogen and phosphoric acid, both of which are so

essential to the success of a tobacco crop. Pulses and leguminous plants generally have equal, if not greater, merits than the above when applied in this way, and are more likely to be suited to the southern parts of this Colony.

Preliminary Cultivation.

Even where winter cropping may be practicable, land that is intended for tobacco should be allowed to remain fallow some months before planting, to permit of its proper preparation. It should receive one ploughing in May not less than 9 inches deep, and one every month or two months afterwards till the period of planting arrives, when, a subsoiler should be used, or failing that a second plough, having its mouldboard removed, should follow up the furrow, at a depth of 4 inches or so. This will either bring an entirely new stratum of soil under the action of the plant, or in the case of old fields land that has had a considerable rest. The benefits to the soil of these repeated ploughings are too universally understood to require justification here. Among others, they are intended :—

To improve the friability of the soil by breaking up its parts, thus enabling penetration by the roots of crops in search of sustenance.

To increase its capacity for the absorption and retention of moisture.

To expose the particles of the soil to the disintegrating and dissolving influences of frost, sunshine, and rain by which their constituents are rendered fit for plant-food.

Besides which, both weeds and the eggs of insects come to grief in these operations.

The final ploughing should be accompanied by a good rolling or clod-crushing and harrowing, so as to reduce the field to as fine a tilth as an onion bed, in which state, other conditions having been attended to, it is ready to receive the seedling.

APPENDIX.

Précis of Manufacturer's Report on Tumut leaf tobacco.

The leaf is good in size, colour, and quality, and more nearly resembles the American than any we have seen. If the price and putting up of such leaf came anything near the former, it would prove a very formidable rival in the market—in smoking quality it is also as good as the American. We consider that such tobacco laid down here would be worth 6½ per lb. Tested for moisture, two samples gave respectively 15·80 per cent. and 14·98 per cent., which is fair, and very little above what we are accustomed to. It is important to manufacturers to have tobacco that will absorb a good deal of water, the Government restricts us to 35 per cent., and on testing yours it carried 32 per cent. From these statements, and tests to which your samples have been subjected, you will see that it stands well in comparison with the American.

The National Prize Competition, 1892.

Irrigation.

Report of the Judge—H. G. M'KINNEY,
Chief Engineer for Water Conservation.

Owing doubtless in a large measure to the favourable rainfall during the past season, the number of entries for the National Prizes for Irrigation in the Coastal District was reduced to one. On the other hand, notwithstanding that the rainfall as a rule was above the average, there was an increase this season in the entries from the country west of the Dividing Range. I have lately had good opportunity for ascertaining that although the Colony has in recent years passed through a period of exceptionally high rainfall, there has been a steady increase of irrigation in the Western Districts. On every important river and on several of the creeks, irrigation is conducted on a steadily increasing scale. It is surprising that so few entries for the prizes have come from the western parts of the Colony; but I have no doubt that the competition will increase as irrigation extends, and as the regulations relating to the National Prizes become better known. It is encouraging that the entries from the country west of the Dividing Range, are fairly representative of the tract of rich land, which extends along the western margin of the range, and marks the beginning of the Great Western plains. The sources of water supply for irrigation in these cases were the River Namoi, the Lachlan River, and the Murrumbidgee River respectively.

Irrigation as applied to General Agriculture.

For the prizes for irrigation as applied to general agriculture, there was only one entry, namely, the farm of Mr. T. P. Wills-Allen, of Gunnible, near Gunnedah. This farm is situated within a valuable pastoral estate, and is worked as an adjunct to this and two other pastoral properties of Mr. Wills-Allen. The objects of this irrigated farm are threefold:—

(1st.) To provide reserves of fodder for dry seasons.
(2nd.) To supply horse feed for ordinary requirements.
(3rd.) To be used as an occasional fattening ground for sheep and cattle.

That the operation of this farm has been highly satisfactory is evidenced by the statement of its enterprising owner that if he had to begin pastoral pursuits afresh, and possessed at the same time his present knowledge and experience, he would, at the very outset, order an irrigation plant as a necessary adjunct to successful management.

As Mr. Wills-Allen's farm was entered in the similar competition last year, and the plant used was then described in detail, it is not necessary to give more than a brief summary of the conditions under which the irrigation is carried out. The land irrigated is rich alluvium, and fronts on the River

Namoi. Under this alluvium, sand and gravel are found at moderate depths, so that there is good natural drainage. The water for irrigation is pumped from the River Namoi by means of a centrifugal pump, worked by a 40-horse power engine. There are two main distributary channels leading in opposite directions from the pump. The water is first delivered into a timber flume, and then passes into one or other of these channels, according to requirements, the flume being provided with simple stop-gates. A short length of each channel at the head is constructed of concrete and masonry, but, excepting these lengths, earthen channels, made with the plough and delver, are used throughout. The extent of the farm is about 600 acres, of which about 400 acres are under crop, chiefly lucerne, while the remainder is grass land, which is irrigated at intervals, according to convenience and requirements. It is, however, Mr. Wills-Allen's intention to increase the area of cultivation, as the pumping-plant is not worked nearly up to its capabilities.

The site for pumping has been very well chosen. The pumping-plant is well suited to the work required, and is kept in excellent order. The management of the cultivation and the choice of implements used leave little or nothing to be desired. The one point which seemed open to objection was that to which I called attention at last year's inspection, namely, the very large quantity of water used. This apparent extravagance is due largely to the absence of minor distributaries, and to the breadth of the existing channels. From the particulars furnished to me, I estimated that the quantity of water pumped up for one watering of the land is sometimes equivalent to a depth of a foot or more over the surface irrigated. In many places a watering such as this would be simply ruinous to the crops, but in the case of Mr. Wills-Allen's property, owing to the extreme porosity of the soil, and the excellence of the natural drainage, no damage is done by this excessive watering. I ascertained that since last year Mr. Wills-Allen has given much consideration to this question, and that he decided to continue his present system on the grounds that:—

1st. The water possesses valuable fertilizing properties, so that not only is no harm done, but, on the contrary, the land is enriched, or at all events its fertility is fully maintained.

2nd. The distribution, in a more economical manner, of the water, by the use of laterals or minor distributaries, would give more trouble in cutting the crops.

3rd. That main distributaries, constructed with a view to more economical use of the water, would be more liable to damage from the sheep and cattle, which are occasionally allowed on the irrigated land.

Under existing circumstances, I see no objection to these views being carried out, but it is necessary that it should be clearly understood that till legislation dealing with riparian rights is passed, all such irrigation is done on sufferance only, and will be subject to such regulations as may be deemed desirable. That such regulations will be necessary in the near future for the protection of irrigators cannot be doubted. On the river Namoi there is very little irrigation except that done by Mr. Wills-Allen, but in times like the present, when the necessity for new industries and new fields of enterprise is keenly felt, it cannot be expected that he will continue to hold such a monopoly. As irrigation on the Namoi develops, the necessity for regulations which will legalise the use of a certain portion of the available water by every landholder will quickly become apparent. Such regulations

will give a legal right, but they will necessarily place a limit on the supply, and this limitation will show the necessity for adopting a more economical system of distributing the water than that which Mr. Wills-Allen has adopted.

Following the system of marks adopted last year, I award the numbers stated in the following table :—

Item.	Detail.	Maximum number of points.	Points awarded.
1	Selection of land for irrigation	15	12
2	Selection of source of supply and nature of appliances.	10	8
3	Selection of crops to be irrigated	15	13
4	Application of water to land...	30	25
5	General economy of arrangements	30	25
	Total	100	83

In regard to the marks here awarded it is necessary to explain that on considering the whole circumstances of the case I came to the conclusion that existing circumstances and the proved success of the operations justify the system adopted by Mr. Wills-Allen, although in many places it would not be allowable, and in many others it would be ruinous. The success of irrigation in this Colony depends on the adoption of methods suited to the circumstances and conditions met with and this is precisely what Mr. Wills-Allen has successfully accomplished.

I beg to recommend that the first prize for irrigation, as applied to general agriculture, be awarded to him.

Irrigation as applied to Orchards.

As already mentioned, the wetness of the past season so lessened the necessity for irrigation in the coastal district that only one competitor entered for the prizes in connection with irrigated orchards. The names of the competitors and the location of their orchards are as shown in the following table :—

Name of competitor.	Situation of orchard.	Source of supply of water.
Thomas Spencer ...	Three miles from Narrandera ...	Murrumbidgee River.
Thomas Tozer ...	Two miles from Forbes	Lachlan River.
George H. Dempsey ...	One mile from Emu Plains	Well in Nepean River drift.

George H. Dempsey's Orchard.

Mr. Dempsey's orchard was entered in the competition last year, and was then fully described. In the interval some minor improvements have been made in connection with the distribution of the water, but on the whole the remarks made in last year's report apply very closely to the present circumstances. The orchard is partly on a slope and partly on nearly level ground, but the whole orchard overlies the Nepean River drift, and through this has excellent subsoil drainage. The water is pumped into two 400-gallon tanks,

which are placed at a sufficient elevation for household purposes as well as irrigation. For the irrigation of the trees on the sloping ground the water is passed into open furrows, while for the comparatively level ground iron pipes are laid on the surface of the ground through the centre of it, and the watering of the trees is done separately, by means of a flexible hose. The iron pipes when not in use are unscrewed and put away, and the flexible hose is similarly cared for. The arrangements are in the highest degree economical and systematic.

Orchard of Mr. T. Tozer.

The irrigated orchard of Mr. T. Tozer, at Forbes, is situated in a bend of the river Lachlan, and about 2 miles upstream from the town. The land is of the most fertile description, consisting of gray alluvium overlying sandy drift, the latter being generally at a depth of 10 to 12 feet. A public road passes through the orchard, dividing it into two parts of about 7 acres and 5 acres in extent respectively, the water for irrigation being taken under the road, in a timber culvert, constructed by Mr. Tozer. The source of supply is the River Lachlan, from which the total lift at the time of my inspection was 34 feet. A centrifugal pump, having a 5-inch delivery pipe, and worked by a 6-horse-power portable engine is used for raising the water. The selection of the site for the pump shows sound judgment, as the water can be taken from it by gravitation to all parts of the orchard. The main distributary channels are well constructed and fairly maintained, but the irrigation of the fruit-trees and vines is roughly done, and no attempt is made at economical or uniform distribution. The orchard is remarkably productive, and it would seem that the ease and certainty with which a splendid crop of fruit can be obtained has led to a certain amount of looseness in the management of the watering. It is necessary, however, to state that Mr. Tozer is a firm believer in the fertilizing properties of the water, and that this would justify a liberal use of it. On the other hand while it has been proved that fodder crops will in some cases bear very profuse watering with advantage, the general experience is adverse to excessive watering of fruit-trees. The fruits chiefly grown here are peaches and apples, but pears, plums, nectarines, grapes, and almonds are also grown, and as a rule with great success. This year the grape crop proved a failure. The yield in the other cases was, on the whole, very heavy, although, as one of the fruit experts of the Agricultural Department pointed out a few days before my arrival, some of the trees were not in a healthy state.

Orchard of Mr. T. Spencer.

The orchard of Mr. T. Spencer, about 3 miles from Narrandera, consists of land which was formerly covered densely with pine scrub. The soil is a reddish loam which if neglected will bake and crack on the surface, though it is easily worked if properly attended to. The source of water-supply is the Murrumbidgee River, and the lift at the time of my inspection was 35 feet. This may be regarded about the maximum, the river at that time being very low. The water is raised by a centrifugal-pump worked by an 8-horse power engine. The bend on which the engine stands is high red land considerably above the level of the highest floods.

The site for the pumping-station might have been better chosen, as, owing to its not being on the highest part of the land to be irrigated, about 4 chains of fluming proved necessary. With the exception of this length, the main distributaries are well-constructed earthen channels in the banks of which,

at suitable intervals outlet pipes of galvanised iron are fixed. The orchard is on ground which has sufficient slope to afford good natural drainage. The distribution of the water is done by means of furrows which are run parallel to the rows of trees. At an interval of about half a day after the flow in the furrows is stopped, a light American cultivator is used to work up the land between the trees, and it is found that by this practice any caking on the surface is prevented. The orchard, which is about 13 acres in extent, is kept in excellent order, and it may be mentioned that Mr. Spencer also irrigates about 4 acres of lucerne and 6 acres of other crops, chiefly for fodder.

The system of marking adopted last year, and now continued is shown in the following table:—

No. of item.	Detail.	Maximum number of points.
1	Suitability of the land as to position, and as to necessity for irrigation	10
2	Suitability as to soil	10
3	Suitability as to water supply, and as to position of offtake or pump	10
4	Application of the water to the land	25
5	Suitability of crops to existing conditions	20
6	General economy in arrangements	25
	Total	100

As the results of my examination of the competition I award marks as follows:—

Item.	G. H. Dempsey.	T. Spencer.	T. Tozer.
1	8	9	8
2	10	9	9
3	10	8	10
4	23	21	15
5	20	20	20
6	23	20	15
	94	87	77

It will be seen from the figures given above that no difficulty was experienced in distinguishing between the claims of the competitors. Items 4 and 6 bear the most important part in deciding on the rival merits, and under these I considered the irrigation done by Mr. Tozer to rank much below that of the other competitors, both of whom have carried out their operations in a highly creditable style. I beg to recommend that the first prize for the best irrigated orchard be awarded to Mr. G. H. Dempsey of Emu Plains, and that the second prize be awarded to Mr. Thomas Spencer, of Mosely, near Narrandera.

Stock Breeding and Fattening in New Zealand.

By A. BRUCE,
Chief Inspector of Stock.

Report to the Minister of Mines and Agriculture.

I. Scope and objects of the Report.

In reporting on these subjects I will, in the first place, notice as briefly as possible the extent and area of the colony—its physical aspects and natural divisions, its rivers and lakes, and its soil and climate. I will next describe how the pastoralists and farmers there are turning to account the great natural advantages which they possess. In doing this I will confine myself to the North and Middle Islands as the stock on the other islands are too few to call for notice.

II. Extent and area of the Colony.

The North Island,

which is nearly the same latitude as Victoria, extends from north to south some 448 miles, and has an average width, calculated roughly, of about 100 miles, with an area of (say) 44,468 square miles, or 28,459,000 acres.

The Middle Island,

the northern portion of which is farther to the north than the most northern part of Tasmania, and the southern portion considerably farther south than the most southern part of that island, is about 450 miles in length, and its width varies from 100 miles in the northern and middle portions to 160 in the southern. It has an area of (say) 58,525 square miles or 37,456,000 acres.

The area of the two islands is thus (say)—102,993 square miles, or 65,915,000 acres—that is somewhat less than one-third of that of New South Wales.

III. The Physical features of the Colony.

The North Island

is hilly and mountainous, with considerable tracts of undulating and level country and valleys intervening. The mountains, which are said to occupy about one-tenth of the whole, are numerous, but do not, with a few exceptions, attain a height over 4,000 to 5,000 feet. The highest mountain in the North Island is 9,100 feet.

The most remarkable feature in the North Island is the numerous hot springs in its central districts. The greatest part of these springs are in the country still held by the Maoris, which is of considerable extent.

The water supply is abundant throughout for local requirements. The rivers are numerous, and some of them, such as the Waikato and Thames, large, and carry heavy volumes of water to the sea. In the centre of the island, again, there are several lakes, one of which, Lake Taupo, is of considerable size.

The Middle Island.

The leading physical feature in this is the Great Dividing Range, known as the Southern Alps. It runs through the island from north to south with numerous lofty peaks, the highest of which—Mount Cook—is said to be over 12,300 feet high. The scenery of some of the portions of this great range is grand in the extreme—the glaciers on both sides of the range descending to within 700 feet of the sea-level.

With the exception of the north-west corner of this island and a small extent of country at its southern end, the main coast range for the greater part of its course runs within a short distance of the sea, and the formation and nature of the country lying between the top of the range and the sea is such as to render it unsuitable for even grazing, being both very steep and rugged, as well as barren.

In the northern portion of the Middle Island

the districts of Nelson and Marlborough, the country is hilly and mountainous, but nearly all adapted for grazing, with valleys here and there between the hills in both districts, suitable for farming.

This portion of the island, as might be expected from its mountainous character, has numerous rivers and is thoroughly well watered.

The middle portion of the Middle Island.

The far-famed Canterbury district: so far as it is to the east of the main range, the northern part of this district is hilly and undulating. Then going southwards, there is a long stretch of comparatively level land between the main range and the sea, with here and there undulating country, gradually rising and becoming hilly, till it meets the dividing range on the west and the hilly country of Otago on the south.

The land in the Canterbury district, east of the main range, is all adapted for grazing, and the greater part also for tillage and easily worked. While the soil throughout a good deal of this district is light, it is very fertile. It is reckoned that the great Canterbury Plain contains about 3,000,000 acres, the greater part of which is well adapted for agriculture.

The southern portion of the Middle Island, i.e., the District of Otago.

This district, to the east of the main range, is hilly and mountainous, with many fine plains, a good deal of undulating country, and valleys suitable for agriculture, a great deal of the land being of very high quality, and some of it of the very highest. The mountains and hills are, as a rule, bare of timber, but are suitable for grazing.

In the Otago district there are numerous rivers and streams and several large lakes in the mountains. One of the rivers—the Clutha or Mollyneux—is the largest in the colony and the district suffers oftener from wet than drought.

IV. The Climate and Rainfall.

1. Temperature.

The North Island.

In its northern portion the mean summer temperature is 65 and 70 degrees (Fahr.), and mean winter, 50 and 55 degrees (Fahr.); while the mean summer temperature of the southern portion of this island is 60 and 65 degrees (Fahr.); and the winter, 45 and 50 degrees (Fahr.)

The Middle Island

again, in its northern portion, has a mean summer temperature of 60 and 65 degrees (Fahr.), and mean winter of 45 and 50 degrees (Fahr.), while in the southern portion of Middle Island the mean summer temperature is 55 and 60 degrees (Fahr.), and the winter 40 and 45 degrees (Fahr.)

The mean annual temperature for the whole colony is:—Spring, 55 degrees; summer, 63 degrees; autumn, 57 degrees; winter, 48 degrees.

This resembles the climate of the middle southern portions of Great Britain, but more equable, and the variations less.

2. Rainfall.

The following is the average annual rainfall at the four principal stations in New Zealand for ten years, ending August, 1891:—

North.		Middle.	
Auckland	39·131	Lincoln	26·691
Wellington	48·600	Dunedin	35·655

Periods of drought are almost unknown in New Zealand, and only in two instances do the records show a whole month at any one time without rain.

V. The land in New Zealand, and its suitability for tillage and grazing.

In the North Island there are said to be some 13,000,000 or 14,000,000 acres, or about one-half of the whole area, including the Maoris country, suitable for farming; but this includes standing forests, swamps, areas of clay marl, and partially covered with pumice, as well as improvable land, on which the tea-tree scrub grows.

In that island the best agricultural and pastoral land is in the southern and south-eastern portions of the island, the cream of it being in the Napier, Gisborne, and Wairarapa Districts on the east coast, and Palmerston, Wanganui, Hawera, and Taranaki, on the west—the very best of the land, when properly laid down in cultivated grasses, carrying and fattening up to six, and even in some cases seven and eight sheep per acre. There is, of course, a greater breadth of land which, properly treated, will carry and fatten five and six sheep and more that will carry and fatten three and four.

There is also some very good country of a limited extent on the Waikato, in the Hamilton and Cambridge districts, but its carrying capacity is not equal to the best land in the southern portions of the island, and in the northern portion generally, the soil, though kindly, is light; while in the south it is in a great many cases deep and strong. This remark, however, applies less to the land on the east than the west coast, but the land on the east has the advantage of being on a limestone formation.

In the middle part of the North Island, which is still in the hands of the Maoris, there are considerable stretches of good land, but large portions of their country are covered so thickly with pumice as to render them valueless for tillage or grazing. Where the land is not in this state, a good deal of it is well adapted, if improved, for sheep; but little or nothing has been done in that way by the natives.

In the Middle Island, it is estimated that there are 15,000,000 acres available for tillage, and 13,000,000 acres of native grasses suitable for merino sheep, which leaves about 9,000,000 barren, snow covered, and inaccessible mountain tops. A considerable portion of the land suitable for tillage is of a very fertile description. This is especially the case as regards some of the land in the Nelson, Blenheim, Christchurch, Timaru, Oamaru, Dunedin, and South Land districts. On some of the holdings in the districts named they have grown 50 and 60 bushels of wheat to the acre, as high as 100 bushels of oats, and from 30 to 40 tons of turnips; while, with English grasses carefully laid down, the land will carry and fatten in some cases up to seven and eight sheep to the acre—in more instances, five and six, in more still three and four sheep, and it is considered but very ordinary land which, with cultivated grasses, will only keep and fatten two sheep to the acre.

On the country again on which the great bulk of the merino sheep are kept, very little cultivated grasses grow, and these as a rule are self-sown. The land on which they run is almost all unimproved and thickly covered with "tussocks," but at the same time with spaces between them with better sorts of grasses—generally the native fescue. The pasture in which the small tussock grows is the best, and tussocks of that description, when young, are freely eaten by the sheep.

The land available for agriculture, tillage, and grazing in both islands may be stated as follows:—

	acres.
In the North Island (say)	14,000,000
In the South Islands (say)	15,000,000
	29,000,000
Under native grasses	13,000,000
Total area available for tillage and grazing ...	42,000,000

VI. Fencing in New Zealand.

As good lasting timber for fencing is scarce in most parts of New Zealand, more especially in the middle portion of the Middle Island, gorse "whin" hedges are very generally used as fences in both islands. A low sod or turf fence is built about 2 feet high, on the top of which the gorse seed is sown, and a temporary wire fence is erected to protect it for two or three years until the gorse has attained a sufficient height, strength, and closeness to keep the sheep. When properly cared for and regularly cropped, the gorse hedge makes a good fence, and is of service also for shelter in winter to the stock which in many cases have no other protection from the cold winds so common at that season of the year all over the colony; but, of course, much more so in the southern portion of the Middle Island.

These hedges, however, call for a great deal of care and attention, and their maintenance is attended with considerable expense. They are also liable to be burned, and the gorse, if neglected, spreads over the land. What is still worse, in the rabbit-infested country, they are great harbours

for that pest. The outcome is that owners have in those parts of the colony began to replace the gorse hedges with wire fences, and even in the portions of the colony where the rabbits have not as yet put in appearance, the same course is being taken, as the hedges are not so secure, and the expense of maintaining them comes to a considerable sum annually, while they harbour other pests, such as the sparrows.

The most approved fence in New Zealand for cross-bred sheep is one of eight wires with the posts 10 ft. apart, and a wooden and iron batten, through which the wires are run, between every two posts. Some, but they were in the minority, considered that seven wires kept close together and making the height less, were sufficient, if the batten between the posts were put in.

VII. Agricultural Seasons in New Zealand.

In May, June, and July oats and wheat are sown. The farther south the earlier. For wheat, 1¼ to 2 bushels. For oats 2 to 2½ bushels.

In August—Oats are sown in the southern half of the Middle Island.

In September—Spring wheat is sown and oats may be still put in. English grasses, mangolds, and potatoes are put in during this month.

In October—Sow barley with grass seeds. Break up new ground and sow with turnips and rape.

In November—Break up new land.

In December—At beginning, breaking new ground; hay-making and turnip sowing.

In January—Fallow land to be worked; and that and barley crop to be attended to.

In February—Harvest month.

In March and April—Sow grass, with rape or turnips. Thresh grain, break up grass land for wheat, and cross-plough fallow land on to May and June.

VIII. Rotation of Crops.

A great deal of the land in New Zealand is suitable for rotation of crops, and the majority of the holders have adopted that system in some form or other.

It has only been by carrying on a proper rotation and by systematic farming that that colony has been able to keep up the heavy export of first-class sheep she has sent away, and maintain the fertility of the land.

On land which has been under cultivation, the usual rotation, followed in the best portions of the North Island and in the Middle Island, has been something like the following:—Land which has been (say) five or six years under pasture, and on which the cultivated grasses have been pretty well eaten or have died out, is broken up after lying fallow for perhaps three months, is cross-ploughed, harrowed with disc, and ordinary harrow, and sown with wheat, oats, or barley.

As soon as that crop is reaped and threshed, and the straw is stacked on the ground to be eaten by the sheep with the turnips, the land is ploughed, and afterwards, at the proper season again, worked, cleaned, and thoroughly tilled, and prepared for the turnip crop which is put in as afterwards described during November or December.

If the land is not very rich or nearly virgin soil it gets from 1 to 1½ cwt. of super-phosphates, or (say) 2 cwt. of bone-dust to the acre, which gives the turnips a start and insures a good crop. The turnips are eaten off with sheep in the end of autumn or in the winter; and, while the sheep are on the

turnips, they are supplied with wheaten or oaten straw, or chaff which they readily eat, and this, of course, is another advantage which a system of rotation secures, adding as it does to the weight and improving the quality of the mutton of the sheep if they are to be fattened, and increasing the carrying capabilities of the land if the sheep are only stores or breeding ewes. When the turnips are eaten off, the land is ploughed, and when sufficiently tilled and a good seed-bed formed for the grass seeds, it is sown with oats, barley, or wheat, and afterwards with the proper mixture of cultivated grasses and clovers for what is termed permanent pasture. If, however, the land is light, the second grain crop is omitted; and if very light, both grain crops are so, the land being prepared when the turnips are eaten off, and the grass seeds sown with the addition of a small quantity of rape or turnip seed.

The land, as thus laid down in grass, is allowed to be in pasture until the cultivated grasses again become too thin and require to be renewed, when the same course is followed; and where the land is fairly good the return from the grain crop alone goes a long way to repay the expense of the rotation, and that from the turnips and cultivated grasses leaves a considerable profit; while the growth of the leguminous plants (the clovers) supplies nitrogen to the soil, and this and the artificial manure put in with the turnips, together with that left by the sheep when eating them off, enables the fertility of the land to be well maintained.

IX. Cultivation of the Land by Contract.

On the larger properties in New Zealand the greater part of the cultivation of the land is done by contract, but, in a few instances, the owners of even large properties keep a strong staff of men, and have a large number of teams of heavy draught (generally Clydesdale) horses, with four in a team.

In those portions of the North and Middle Islands where the land is light, these four-horse teams work three-furrow ploughs; but on the heavier land, especially in the southern and eastern portions of the North Island and the southern portion of the Middle Island, they work only the double-furrow plough.

The following are the rates ordinarily charged for some of the work:—

Ploughing 4 or 5 inches deep, at per acre... ...	5s.
Disc-harrowing, each time	1s.
Ordinary harrowing, each time	1s.
Sowing, including rolling and covering	9d.

X. Capabilities of the Land under Rotation.

Where the land is exceptionally good, the owner, following such a rotation as this, on breaking up the grass, gets, if the crop is wheat, from 33 to 45 bushels to the acre; and if it be oats his return will be from 60 to 70 bushels.

Next season, on land of that description, if it be at all a favourable one, and due care has been exercised in preparing the land, the turnips, with the usual allowance of chaffed hay or straw, will fatten from fifteen to twenty sheep to the acre.

The next season's crop of cereals (it is usually oats or barley) should be as good as the first grain crop, and with it the grass and clover seeds are sown. They are, of course, cut with the grain crop, but if the autumn is favourable they come again sufficiently to afford, with the stubble, a good deal of pasturage for sheep.

The next season, if the grass and clover have been properly put in, there is a strong, close growth of all the varieties sown, and the crop is either saved for hay or pastured with sheep, as the owner may decide. It is generally pastured, and land of the description alluded to should keep and fatten annually, for two years, six or seven sheep to the acre; where it is very good, but not exceptionally so, its carrying and fattening capabilities might be put at four or five sheep to the acre, and where only fairly good from two to three sheep, while taking the average capabilities of the whole colony it is estimated that where the land has been fairly laid down in cultivated grasses, which are renewed every five or six years, they are carrying and fattening from two to three sheep to the acre.

XI. Grasses and Clover.

Nearly all the English cultivated grasses and clovers grow well in New Zealand, especially on the moister land, where they retain their hold better and are green and succulent right through the summer, but, though moist, the land where grasses are sown should be properly drained—not at all water-logged. Where the land is at all good these grasses have excellent feeding properties. Even on comparatively thin soil, under proper tillage, and aided with small quantities of manure, they grow well and give good returns.

For some time the most of the grass, as well as the turnip seeds, were imported from England or Scotland, but now the greater part of them are saved in the colony. So favourable is New Zealand for the growth and saving of these seeds that considerable quantities of some of the kinds are now exported to Europe, and it is believed that New Zealand is one of the principal sources from which Great Britain and Ireland now draw their supplies of Cocksfoot seed.

XII. The usual Mixture of Grass and Clover Seeds sown, and the Quantity per acre.

In New Zealand the following is the mixture of grasses generally sown, and the quantities of each, when laid down with cereals:—

Perennial rye-grass ...	25 lb.	White clover	2 lb.
Cocksfoot	5 lb.	Red clover	2 lb.
Timothy or Crested dog's tail	2 lb.	Cow-grass	2 lb.
		Alsike	2 lb.

Where the land is dry crested dog's tail might be substituted for the Timothy, as it will not thrive in dry ground, or, instead of taking the crested dog's tail, the cocksfoot and cow-grass might each be increased 1 lb.

When sown without cereals, it is customary to add from ½ lb. to 1 lb. of rape or turnip seed to the mixture. These grow more quickly than the grasses and clover, and not only shelter them on coming through the ground, but supply the sheep with a full bite of early succulent and nutritious food. Of the two the rape grows the more quickly than the turnips. Indeed, it is thought by some owners, too much so, to be made the full use of, and the turnips are now frequently preferred to the rape for this purpose.

XIII. Grasses sown in New Zealand.

1. Perennial Rye-grass.

Of all the varieties of cultivated grasses this is not only the most generally grown, but also that which forms the principal grass in the mixtures of seeds sown throughout New Zealand. Out of some 40 lb. of seeds, usually sown to the acre there are generally as much as 25 lb. of rye. This grass, with a fair amount of moisture and temperate climate, grows on almost all descriptions of soil, even on stiff cold clay land and light stony soil deficient in lime, and on land where no other grass of value will grow; but the richer the land, if the drainage is good, the better and more permanent the rye-grass will be. It perpetuates itself in these cases both by seeds and rootlets. Indeed, on such land it may be said to be really perennial, but on soils of medium and poor quality it requires to be renewed from time to time (say) every four or five years.

There are none of the grasses so nutritious as the rye except the foxtail; and it is noted for the excellency of its herbage, the great weight of produce to the acre, its early and late growth, and the manner in which it stands the trampling of the stock. It is also especially valuable for the amount of food it yields during winter; and so well has it done in New Zealand that there is now a variety peculiar to the colony called the "Poverty Bay," which is found to be superior to any imported seed in standing and feeding qualities.

In 1891–2 no less than 864,511 bushels of rye-grass seed were grown in New Zealand. It is usually harvested by stripping, and the average yield on good land is from 15 to 20 bushels per acre.

In taking the seed the paddock is grazed till midsummer, when the stock are taken off for a few weeks and paddock shut up.

The price per bushel ranges from 3s. 6d. to 4s.

2. Cocksfoot.

This, with the exception of the rye-grass, is the most generally sown of all the cultivated grasses in New Zealand. It is a strong hardy grass, and more than holds its own with other grasses and clovers. Indeed, it sees the most of them except rye-grass out—in some soils even that grass; and so much is this the case that, where the land is very good, considerably less than the proportion of cocksfoot given (one-eighth of the whole mixture) is put in, lest that grass should monopolise the land. It grows well on hill-sides, where it is not so liable to run into tufts as on the flat land, and it shoots with every shower of rain. Where the soil is good, cocksfoot, when kept closely eaten down, is a good fattening grass, but if allowed to shoot up and ripen it becomes hard and comparatively innutritious, inclined to become bunchy or tussocky, and the stock, especially sheep, will not eat it unless actually obliged. In no part of the world does the cocksfoot do better than in New Zealand. It frequently goes 20 lb. to the measured bushel, while the standard is only 12 lb. Large quantities of this seed are now, as has been said, annually exported to Europe. It sells in New Zealand at from 3d. to 4d. per lb., and as much as 572,425 bushels were grown there in 1891–2.

3. Timothy.

Where the land is fairly good, the soil damp, and the climate at all moist, this grass, which makes very good sheep-feed, does well, and should in such cases always be in the mixture sown; but it should not be sown in dry

country; but it flourishes in clay and moist soils, and is unsurpassed in peat. No grass will better bear extremes of heat and cold. It produces a heavy hay crop, and is exceedingly nutritious when young, and more so when old and seeded.

4. Crested Dog's Tail.

This is one of the chief British sheep-grasses, especially in upland districts, and is supposed to have a beneficial influence in preventing foot-rot. The sheep are very fond of the leaves, but, like the cocksfoot, it should be kept well caten down, as the seed-stems become hard and the sheep leave them.

It thrives well in compact soil, and is very hardy. The roots are hard, and the plants are adapted to dry soils and will withstand droughts.

It also does well in tenacious clay. There is hardly any soil it will not thrive in.

It is not much grown in New Zealand, and it is only suggested as a constituent part of the mixture where the Timothy has to be omitted.

5. Meadow Fescue.

This grass is considered by some authorities a very valuable one for permanent pasture on good land, but is not as yet very generally grown in New Zealand, and this may be accounted for through being liable to be affected with ergot, if it is let run into seed, and ergot acts as a poison on the stock.

XIV. The Clovers sown in New Zealand.

1. Perennial White Clover.

Has both fibrous and tap roots, which enables it to maintain itself in different soils. It grows best in mellow land containing lime, and on all clay soils rich in humus or gravelly clay. It forms an essential constituent in every good pasture, but is better for flesh than milk, and is of special service in fattening sheep. The white clover flourishes in New Zealand and keeps the hold of the ground very well—long into the summer—especially in the country where they have the limestone formation. Indeed, at times its growth is excessive, for it takes possession of the space which could be better occupied with other clovers or grasses.

2. Red Clover.

Is a strong plant, will grow on almost any soil, and contains a great deal of moisture. Winter and spring frosts are injurious to it. It is not very well suited for permanent pastures, but should form a proportion of an alternate mixture. Its great root growth during the two years of its existence is favourable to succeeding crops, carrying as they do nitrogen into the soil. It grows well in New Zealand, and now that the Humble bee has been introduced it has been fertilised and the seed saved.

In New Zealand it is generally sown with a spring cereal crop, mostly oats and barley, lightly grazed in autumn, and next year cut in November as hay giving from 2 to 3 tons to the acre.

The after growth is allowed to seed and ripens in March, when it is cut and threshed, giving from 200 to 300 lb. per acre, which sells at 5d. to 6d. per lb., or £10 to £11 per acre.

3. Cow-grass.

Is what is more properly termed the perennial red clover. It grows very well in New Zealand. It is an invaluable plant, and should be included in every mixture for permanent grass. Its roots reach well down into the subsoil, which enables it to obtain moisture in the hottest weather. Even in rather poor soil it produces a good quantity of succulent food. It stands the frosts well, better than the broad-leafed red clover. The principal difference between the two clovers is that the cow-grass has a somewhat taller, smoother, and, except in its very young state, a less hairy stem, and has a stronger, less fibrous, and more penetrating root. It carries its flowers above its foliage, and surpasses the broad clover in succulenee. Its stalks are generally solid, while those of the broad clover are hollow, and it produces less seed.

4. Alsike.

Is peculiarly adapted for damp soils, endures heat and cold well, will succeed in undrained clays better than any other clover, and is the only clover which will stand irrigation. For hay, alsike is superior to white clover, and for pasture produces more, and is eaten more readily; while it is more leafy and less pithy than red clover. Its nutrition is greatest at the flowering stage; and its value for pasture is very great. It flourishes in the same deep soil as Timothy, and does well with the other grasses mentioned in the mixture.

5. Lucerne.

The good qualities of this plant are too well known in New South Wales to require anything to be said here with respect to them, or to recommend owners whose land is adapted for its cultivation to sow it. In New Zealand, the grasses already mentioned have done so well and have so well suited the system of farming generally adopted in that colony that comparatively little lucerne has been sown there; but where it has been tried it has answered quite as well in that colony as in this, and owners in the warmer portions of the colony are—now that wheat is not paying so well—turning their attention to lucerne, and a good deal more will now be grown there.

XV. Laying Down Fern, Bush, and Scrub Land in Pasture in New Zealand.

1. Fern Land.

In dealing with this description of land the ferns are burnt off in the first three months of the year, and a mixture of grass seeds of the kinds, and in proportion already mentioned according to the nature of the land, the climate, and other circumstances, is sown in the ashes, and, as there is not so much of them as in Bush land, $2\frac{1}{2}$ instead of 2 bushels require to be sown. The seeds spring with the first rain, but with them a strong growth of young ferns comes up, and to keep the ferns down and kill them out the land is heavily stocked with sheep and sometimes with cattle. When young and just through the ground the fern is eaten, but not very readily, by stock, the one set of stock not being kept on too long for that purpose, as they would fall away in condition. Fresh sets have therefore to be put on, and this course has to be followed for two or three years, otherwise the fern would again overrun the land. By that time, however, if kept properly down, they cease to grow, and they have of course done so to a less extent every year.

The cost of burning off and seeding fern land is about 15s. per acre, and fern land will keep from one to three sheep to the acre, according to the quality of the land and the success of the burning off and seeding.

2. Bush Forest Land.

The expense again of laying down the bush forest land, which is, as a rule heavier and better than the fern land, is much greater, as it is usually covered with trees, saplings, creepers, vines, scrub, and under-growth. In preparing the land (the felling and scrubbing is generally done in the winter season) the creepers, scrub, and under-growth have to be cut near the surface and overhead with a slash hook. After that the saplings and trees are felled, and when the whole is withered and dry, at the end of summer, or early in the autumn, the whole is set on fire, the aim, of course, being to make the burning as complete as possible; for, with a good burning, the grass seeds which are sown in the ashes in the autumn come up close and strong, but it is otherwise if the burning is badly done, as the rubbish covers the ground and allows the weeds to keep possession of the ground, thereby preventing the grass-seeds from obtaining a proper footing.

If the soil is good, and the burning successful, bush land treated in this way will keep three to four sheep to the acre, notwithstanding that it may for years remain thickly covered with the felled trees. In the course of five or six years, when the timber has become rotten, it is usual to "log up" and burn it off, principally with the view to cultivation, but sometimes merely for the sake of the pasture.

The felling, burning-off, seeding, and sowing an acre of bush forest land costs about 32s. 6d., the work being all done by contract.

There is no part of this Colony, except perhaps the rich scrub lands of our north-eastern coast country, where exactly the same system as here described could be followed by us; but I think that the same end would be attained at a comparatively small expense on the best portions of country, like that in the neighbourhood of Armidale, Guyra, and Glen Innes, by adopting some such course as the following:—To ring and kill the large trees, to grub out all the smaller ones, and having thus cleared the land sufficiently to admit of its being cultivated, to plough and work it till it is brought to a fine tilth, and then sow with some such mixture of grass and clover seeds as that given in this paper. In this way the seed would be put in as it ought to be, every grain would have a chance to germinate, and, if the season is at all favourable, a good growth of cultivated grasses would result at a comparatively small cost, which would last for at any rate five or six years, keeping from three to four sheep per acre; and when the larger trees and their roots had become rotten they could be taken down and burned, and the land cleared for fresh tillage.

3. Manuka or Tea-tree Scrub Land.

This scrub, which in some places, more particularly in the northern portion of the North Island, covers extensive stretches of the flat country, and grows to a considerable height, is cut down close by the ground, and generally allowed to lie until a second growth of young scrub comes up through the old when the whole is burned off, and the grass and clover seeds are sown in the ashes, the scrub seldom growing again.

Tea-tree land is generally light and its carrying capacity is comparatively small.

The cost in this case should be about 20s. an acre.

I am not aware whether scrub has ever been treated in this way in Australia. If it has not it would be well worth giving the New Zealand practice a trial, for there is plenty of scrub in this Colony, which, when cut, as it usually is, and burned off when dry, regularly grows again.

XVI. Laying-down land, which has been previously cultivated, with Grass-seeds.

1. Preparation of the Land.

Whether the cultivated grasses are to be sown with cereals or without on land which has been cleared and tilled, those who grow them to the best advantage work the land on which they are to be grown in a thorough manner, so that there is not only a fine mould and good seed-bed on the surface, but they are careful that the soil, to a fair depth, is also well stirred by ploughing, cross-ploughing, disc and ordinary harrowing, and rolling, the cost of which, at contract price, would be something like the following per acre:—

	s.	d.
Ploughing (say) 5 inches deep	5	0
Cross-ploughing (say) 5 inches deep	3	0
Disc-harrowing (say) 5 inches deep	1	0
Ordinary harrowing	1	0
Seed, sowing cereals and grasses, and covering...	2	6
Total	12	6

2. Time when Grasses are Sown on Land previously Tilled.

In the North Island and the northern part of the Middle Island the greater part of the grass-seeds are sown in the month of September, and some in the month of October. In the southern portion of the Middle Island they are put in from October to March.

Where the land is very cold, wet, and heavy, the later the sowing the better, and where the soil is light and warm the earlier the better; but of course the time of sowing must be regulated by the rainfall.

3. How Grass-seeds are Sown.

Where the land is rich, or has recently been manured, grass-seeds are laid down with barley, oats, or other cereal after a crop of turnips, which has been eaten off by sheep; and in other cases, which are perhaps the more numerous in the northern portions of the North Island, the sowing of the cultivated grasses follows directly on the turnip crop without any cereal.

XVII. Root and Green Crops.

1. Turnips.

The turnip crop in New Zealand is a very important one. In 1892, according to the Statistical Register for the colony, there were 422,354 acres under that crop.

(1.) *Turnips on Tussock Land.*

In breaking up tussock (new) land for turnips after the tussocks are hoed up and burned, the seed is generally sown in November or December broadcast, to prepare it for future crops; and if well laid down, and in a fairly favourable season, the yield is good, nothing suiting the turnips better than virgin soil; and after the turnips are eaten off by sheep the land is properly tilled and a grain crop taken.

(2.) *Turnips on Cultivated Land.*

Supposing it was intended to crop land from which wheat had been taken with turnips, and that the land had been broken up in April and allowed to lie fallow till the end of the following August or September, it would then be cross-ploughed and worked, cleaned, and prepared for turnips, which are sown in the months of November or December.

The following statement of the work done in laying down turnips is moderately heavy, and the cost at present contract prices per acre are here given:—

	s.	d.
Ploughing and cross-ploughing	6	6
Disc-harrowing one or two times each, at 1s. ...	2	0
Harrowing with ordinary harrows	1	0
Seed and sowing, including rolling and covering in one operation	1	6
	11	0

In former years turnips were sown broadcast with cannister machines, and where they came too thick the harrows were run through them. They are now sown principally in drills with machines which sow the seed and at the same time apply (in front of the seed) about 1 or 1½ cwt. of bone-dust or other fine manure to the acre. This system brings on the young plants much more quickly, and thus protects them from the fly; and still another improvement is for the drill to water (which some machines do) the land into which the seed is dropped.

If the sowing is well managed no thinning nor hoeing is necessary, but if they require it a scuffler or grubber is drawn across the drills to thin out some of the plants, when the turnips grow in bunches of three and four.

While the cost per acre in this way is a moderate one, fair to very good crops are got. They run from 15 to 30 tons per acre, on which, with the addition of some chaff, from ten to twenty sheep per acre are fattened, and double that number of growing or store sheep or of ewes can, with what grass they can get, be wintered and kept in good condition for those classes of sheep.

Instead of nets, as used in England, temporary wire fences are put up in the field to portion the turnips off to small lots of the sheep, and make them eat the roots up clean as they go.

The turnips-seed sown are generally (1) A small quantity of Devonshire grey stone (a soft quick-growing white turnip) for the sheep to commence with; (2) Aberdeen yellows, both purple and green-topped, which form the principal portion of the crop; (3) A few acres of Swedes are occasionally put in, but Swedes, though very fattening and good keeping turnips, are too liable to be attacked by the fly to be grown in any great breadth. They have to be sown in prepared drills, and cleaned, and hoed as in England, which entails more expense than owners generally care to incur.

The object for which the turnips are grown is of course to fatten sheep, and they answer the purpose admirably, especially as they are now usually helped with oaten or wheaten chaff. This is supplied in large portable water-tight feed boxes set on wheels. As much as twenty or more sacks of chaff can be put at a time into one of these boxes, from which the chaff falls through a

narrow opening at the bottom as required into the feed troughs fixed under the boxes, the roof of which extends over and protects them from wet. In this way the sheep have a continuous supply of fresh chaff, and they are at the same time provided with rock salt.

Spring wheat, oats, or barley, usually follows turnips, and the grass and clover seeds are sown with these cereals. When a grain crop is not taken after the turnips, the grass and clover seeds are, as already stated, sown with a small quantity of turnip or rape seed.

(3.) *Catch Crop of Turnip.*

It suits very well at times when land is in good heart to put the scarifier through a stubble field in the end of February, or part of March, and sow it with turnips, to put the lambs on in the end of autumn or beginning of winter. When a crop can be got in this way it is a very great help to them.

2. Mangels.

Considerable breadths of mangels are grown in some districts. They are a more costly crop than turnips, as they must be sown in prepared drilled land and hoed; and they are not so suitable for cleaning the land as turnips as sowing does not commence till November, which gives ample time to destroy the weeds. This is lost with mangels, which must be sown in October.

The great advantage in mangels is their keeping property. They have only reached the primest condition when the turnips are exhausted; and they, besides, contain a greater amount of nutrition. They are invaluable for stud sheep. Mangels are only sown in rich land, and heavy crops are got with proper cultivation. From 30 to 60 tons per acre are not uncommon.

XVIII. Green Crops.

1. Rape.

This is the principal green crop in New Zealand, and fattens well in certain seasons. Although it is somewhat subject to blight, it forms a very valuable change of food for the sheep, and is, of course, of special value for lambs, coming as it does in the end of autumn and periods of the year when the pasture as a rule is dry and scanty. It is sometimes sown on a first furrow as a chance crop, when, if it succeeds, the benefit is great, and if it fails it is not a matter of much moment, as the outlay is small, for 10 lb. of seed will sow an acre, and the price is only about 3d. per lb.

When sown as a catch crop, as it generally is (say) after wheat or some other cereal, the scarifier is put through the land immediately the crop is harvested, and before the surface soil is hardened by the action of the sun. The land is then well harrowed and brought to a fine tilth, and the seed can be sown with a seed barrow the same as lucerne. Instead of using the scarifier some use the skim plough. The seed should simply be rolled in, and not covered too deeply.

The rape is also sown early in spring, and coming well up as it does before the grass, it is a great help in districts where the winters are rather severe and long.

In light land spring sowings of rape answer best, and on heavy land autumn sowings do so.

Rape, as already mentioned, is also largely sown with cultivated grasses as it adds very much to the amount of food grown, and, while being eaten off by the sheep the young grass plants get safely trodden into firm ground, and the manure left by the sheep greatly benefits the pasture.

2. Oats.

More particularly the Dunn oats are sown as a green crop, and after they have attained a height of 4 or 5 inches are eaten down twice, and, if the land be very good, even three times before they are shut up for the grain crop.

This is done in two ways:—

(1.) The land is ploughed (say) in July or August, allowed to be fallow until the following February, and then cross-ploughed, or scarified, harrowed, and sown; or

(2.) As soon as the grain crop has been taken off (say) in the month of February, the land is ploughed or scarified and harrowed, and the oats sown.

3. Rye.

Is also sometimes grown as a green crop.

4. Wheat.

Wheat put in early is frequently dealt with in the same way and eaten down once, and sometimes twice, if the land is good, and the season a fairly favourable one, the yield of grain is increased, and a considerable amount of succulent food is obtained for the lambs, which helps them to stand the winter better.

5. Cape Barley.

Is sown to some extent for sheep, but more for dairy cows and horses. It is extremely hardy, and comes early to maturity. Sown in March it is ready in May, and it may be pastured twice at least till the beginning of October, when it is shut up and a crop of 40 or 50 bushels of barley reaped.

XIX. The number, breed, and distribution of the Sheep in New Zealand.

1. Number of Sheep in the Colony.

The number of sheep in New Zealand at 1st January last is given at 18,000,000, of which 8,000,000 are in the North Island, and 10,000,000 in the South.

2. The breeds represented, and their estimated number.

Of these, again, it is estimated that something more than one-third, say 6,000,000, are Merinos; something less one-third, say 5,750,000, Lincoln and crosses, in which the Lincoln blood predominates; considerably more than one-sixth Border Leicester and English Leicester and crosses, the Border Leicester largely predominating, say 3,600,000; considerably less than one-twelfth, say 1,150,000, Romney Marsh and its crosses and one-twelfth, say 1,500,000, Shropshire South or other downs and their crosses.

3. Distribution of the Sheep in New Zealand.

In the North Island.

There are about four-ninths of the whole of the sheep in the colony (say) 8,000,000, and they are increasing fast with the large extent of bush land now being brought under cultivation there. The sheep in this island consist almost entirely of cross-breds, the greater part of them having a large share of Lincoln blood.

In a good many cases, especially where the land is wet, Romney Marsh rams are used, and Border Leicesters are now being introduced from the Middle Island in considerable numbers. The Shropshire and Southdowns have also representatives in this island, but their number is not large. There are only a few Merinos in the North Island—in the high country to the west of Napier.

In the Middle Island.

In the better portions of the northern part of this island—in the Nelson and Blenheim Districts—longwools, downs, and cross-breds are kept and fattened, with Merinos in the hilly and mountainous portions. Then in a stretch of country along the eastern coast, some 50 miles wide and 300 long, where more or less of the land is cultivated, longwools, downs, and cross-breds are kept and fattened; and in a tract of hilly and mountainous country, between that just described and the snow line, Merinos are kept.

To put the matter roughly, so far as regards the Middle Island, it may be said that one-third of the Middle Island is stocked with long woolled downs and cross-bred sheep, one-third with Merinos, and the other third is the country carrying horses and cattle, and the rugged barren and snow-covered mountains, principally, of course, on the West Coast.

XX. Description of the breeds of English Sheep.

1. The Lincoln.

Is a large strong-boned sheep. It has a somewhat large head, and it is a characteristic of the breed to have a tuft of wool on the forehead. Its form and shape as a mutton sheep are good, and it has the shoulder and back well covered. It fattens very readily on rich pasture, but the mutton of the pure breed is coarse if the sheep are allowed to reach anything like maturity. The fleece, as regards length of staple, lustre, and weight ranks very high; good pure-bred stud rams clipping from 14 to 17 lb., and some high-class sheep as high as 20 lb., and pure-bred ewes from 10 to 12 lb., of soft lustrous wool.

Among the recommendations of the Lincoln crosses may be mentioned :—

(1.) Where land is good, the country sound, and the grass plentiful and nutritious, or where they have sufficient cultivated grasses and turnips the Lincoln crosses do remarkably well.

(2.) They come earlier to maturity, and are heavier weights at 12, 18, and 24 months than any other breed, while the mutton—when the sheep are prime and killed they weigh from 55 lb. to 60 lb.—is good both in appearance and quality.

(3.) The Lincoln crosses have heavier fleeces, and, as a rule, their wool brings a better price per lb., on account of its length and lustre, than that of any other cross, except perhaps the Border Leicester.

Among the objections brought to this cross, the following may be mentioned :—

(1.) They do not thrive well on middling or inferior country, nor where the feed is scanty or of inferior quality, nor where they have far to travel to water.
(2.) Their constitution is not so robust as those of the other crosses, and where the circumstances are such as to induce lung or other worms, or indeed any other ailment, they are more likely to to be affected than other crosses. They cannot stand much wet without suffering.
(3.) The percentage of lambs is somewhat less, and the loss of lambs in lambing is said to be greater than in the case of other crosses, on account of the comparatively large head and strong bone of the Lincoln rams.

2. The Border Leicester.

In the pure sheep, the head, though rather wide between the eyes, is comparatively small and light behind the ears. The face, which has no tuft, is white, and the head is bare well back behind the ears. This sheep stands rather high on the leg and is light in the belly, but has a wide chest, well-sprung rib, long body, broad back, and good depth of flesh; and with its good form and shape and small bone the Border Leicester is an excellent butcher's sheep.

The wool is fairly long and soft, in little locks, and not very open, but rather scanty on the belly and legs. The pure bred stud rams clip $9\frac{1}{2}$ lb. to $10\frac{1}{2}$ lb., and exceptionally good rams 12 to 13 lb.

The good qualities of the breed for crossing with the Merino are said to be :—

(1.) It is a vigorous robust sheep with good feet, and the crosses do well on anything like good country, and come to maturity early, sheep which have been well kept weighing 65 lb. at twenty-two months old.
(2.) The fleece is a good profitable one, though not so heavy as that of the Lincoln cross.
(3.) The head being small and bare and the bone fine, the losses in lambing when the Border ram is used with the Merino ewe are said to be less than in the case of the Lincoln.
(4.) The adaptability of the Border Leicester to the circumstances.
(5.) Its high position, both as regards the appearance and quality of the mutton. It is believed that the high price of the Canterbury mutton is largely owing to a large proportion of the sheep being of the Border Leicester cross.

The objections taken to the Border Leicester are :—

(1.) It stands too high on the leg.
(2.) The fleece is light compared with the Lincoln, and when the Border Leicester rams are used beyond the one cross there is a very large falling off in the weight of the fleece and length of the staple.
(3.) Although the head of the Border Leicester is not so large, the width of the chest and largeness of the shoulders of this breed are said to cause a good many losses in lambing.

3. English Leicester.

The English Leicester is the smallest of all the Leicesters, and has been the most improved (by Bakewell) of any of the long-woolled breeds, so much is this the case that it has been used to bring a good many of the other English breeds of sheep to the advanced position as regards aptitude to fatten and early maturity, which they now occupy. In the pure sheep of the English Leicester breed, the head is smaller than that of the Border Leicester, the face is white with a blue tinge, the bone is very fine, the hind-quarters are often rather small, the temper is mild, the aptitude to fatten great, and the maturity early. The mutton, if the sheep are killed between twelve and eighteen months, is fairly good, older than that it is greasy and inferior. This breed carries a fairly heavy useful fleece.

The crosses of this breed have to recommend them:—

(1.) Their compact well-shaped carcass.
(2.) Their small bone.
(3.) Their aptitude to fatten.
(4.) The comparatively heavy fleece for their size.
(5.) The less risk of death in lambing, through the smaller size of English Leicester rams.
(6.) The suitability of the cross to middling and even inferior country.

The objections to this cross are:—

(1.) They do not come to the same weight at the same age as the Lincoln, and Border Leicester, and Romney Marsh crosses.
(2.) The mutton is not so good even as the Lincoln, through being inclined to be too fat and gross, and its lack of red flesh.

4. The Romney Marsh or Kent Sheep.

"Professor Wallace" describes the Romney Marsh as a hardy, good-milking, active sheep, well suited for hilly pasture. Its face is white, and it resembles the Cheviot in general appearance. Like a good many of the other English breeds, he says the Romney has been improved by the introduction of English Leicesters. Its forehead is broad, and it usually, though not always, carries a forelock. It is especially distinguished for compactness of form and strength of bone. It crosses well with other breeds, and its mutton is of the kind in demand in the British markets.

He describes the wool of this breed as being of good quality, and the fleece the densest of all the longwools. "Mr. Roberts" again, has not a high opinion of the wool of the pure-bred Romney, which he says runs off very much in quality in the breech.

The qualities which recommend the use of rams of this breed for crossing purposes are:—

(1.) Its hardiness, and the power of resisting to a great extent the attack of worms, fluke, and foot-rot.
(2.) The weight and density of the fleece.
(3.) The weight and quality of the mutton of the cross.
(4.) The suitability of the Romney ewes, through being good milkers, for breeding fat lambs for market.

The objections which have been raised to the use of this breed for crossing are:—

(1.) It is rather low in early maturity.
(2.) The want of sufficient covering of flesh and fat on the loin and back, but especially on the top of the shoulder, which even in good specimens of this breed is higher than the back.

5. The Southdown or Sussex.

This is the breed through which all the other downs have been improved. The head is small, and closely woolled on and up to the ears (naked ears are objectionable) and on the forehead. The face and legs are of a grey-brown colour.

The Southdown is very short on the leg, broad in the chest, round in the barrel, particularly good in the hind-quarters, and altogether very compact and symmetrical in form and shape, deeply fleshed, and well covered all over, especially on the back and rump. The mutton is excellent and brings top price, but the fleece is short and light, ewes only clipping from 3 to 4 lb., and crossed with the Merino the return of the wool is so low, both in quality and quantity, as to lead owners to be very shy of using rams of this breed for crossing, although the mutton, both in appearance and quality, is the very best. The Southdown rams and Merino ewes make excellent fat lambs, but even for fat lambs some of the other downs, if downs are to be used (the Shropshire, for instance), answer about as well, and, if any of the drop are to be put again to the ram, much better.

6. The Shropshire Downs.

This breed was established by crossing the local breed with the Southdown for quality, and then introducing the Leicester for size and length of staple.

The face is longer and larger than the Southdown, the nose is slightly Roman, and the ears larger and more lively. The face and legs are of a blackish-brown, more inclined to black, and usually tinged with grey round the nose, eyes, and jaw. White on the face or legs, or black spots in the fleece, are objectionable.

The Shropshire, like the Southdown, is excellent in form and shape, and somewhat heavier, and the crosses of this breed with other English breeds, or even with the Merino, when sold as fat lambs pay well, but kept till they are older the return is not so good, either in weight of mutton or wool, as the Leicester cross; but the quality of the mutton, especially in the Shropshire and Merino cross, is excellent both in appearance, shape, and flavour.

The fleece of fairly pure-bred Shropshire ewes should average from 7 to 8 lb.

The Shropshires stand very high as regards percentage of lambs.

7. The Hampshire Downs.

This breed has a strong resemblance to the Shropshire, except in the matter of the fleece and wool, which in the Hampshire is not nearly so saleable as the Shropshire, and, besides, is only about half the weight. For this reason alone the Hampshire is not a desirable breed to introduce into this Colony.

XXI. The Views of the New Zealand Breeders as to which is the best English Sheep for Crossing with the Merino.

1. The Lincoln and Merino Crosses.

The opinion in New Zealand is that on rich, sound, well-watered pasture, where the feed is abundant and nutritious, the Lincoln is the most suitable English breed for crossing with the Merino, for in such a case these crosses give the best return, taking into account both wool and mutton. But to do this they have to be kept going on good feed and plenty of water from the time they are dropped till they are fit to slaughter. Then, again, the increase of the Lincoln cross is more affected than most of the other crosses by too much wet, by middling or inferior pasture, but especially by deaths in lambing.

As sheep to breed from, the ewes of the Lincoln and Merino crosses through their good frames and excellent fleeces, are superior for that purpose to any other, provided they have been reared in sound country and are free from worms.

2. The Border Leicester and Merino Crosses.

On rich pasture or other nutritious food give nearly as large a return in weight of mutton as the Lincoln cross, and of a better quality and form.

The Border Leicester crosses, while standing well as regards early maturity, are hardier than the Lincoln, and will thrive on even middling country. They generally, too, adapt themselves better to the circumstances in which they are placed than the Lincoln, or perhaps almost any of the other crosses.

Then again the well-bred Border Leicester ram gives his progeny width of chest, rotundity of frame, and depth of flesh, and they handle particularly well on the rump, loins, back, and shoulder, while the mutton is excellent.

The weak point in the Border Leicester is the comparative lightness of the fleece and lack of covering, especially on the belly and legs. It is said that these crosses cut 1½ lb. less than the Lincoln; but it brings a fully higher price. Unless, therefore, the breeder can put Lincoln rams to the ewes of the Border Leicester cross, it is not deemed good management to breed from them, as it is certain that a considerable loss in weight of wool would follow the use of the Border Leicester rams a second time.

3. The English Leicester and Merino Crosses.

Sired as they are by sheep which stand fully as high as any breed in aptitude to fatten and early maturity, these crosses on real good pasture make, perhaps, better progress than those of any other cross, and they do fairly well on middling and even poor country, though as lambs and weaners the sheep of this cross are less hardy, and the animal increase from the cross is less than in the case of some of the crosses. On the other hand, through the fineness of the bone and the smallness of the head of the English Leicester ram, the losses in lambing in this cross are very low, and make the annual increase quite an average one.

Although rather light in the hind-quarter, these crosses are like their sire short on the leg, and so far as form is concerned, make very shapely carcases; but the mutton even when young is not first quality, and brings a second-rate price; and when the sheep are thoroughly well done to, and kept for over twelve months, the mutton is apt to be gross and greasy.

The fleece of the cross is heavy for the size of the sheep, and of fair quality.

This cross is not in much favour in New Zealand. It is not high in stamina, but it is believed that the principal cause is that it is not liked by the freezing companies.

4. The Romney Marsh and Merino Cross.

On rich land these crosses do nearly as well as the Lincoln, and quite as well as the Border Leicester so far as increase of weight is concerned, and although the carcass is not so well shaped as the Border Leicester, the mutton is nearly as good, and somewhat better than the Lincoln cross. Like its sire, the Romney Marsh cross is much less liable than some of the other crosses to foot-rot, and fluke, in wet country, but it does not thrive so well unless the pasture is both nutritious and plentiful.

While the mating of the Romney Marsh ram with the Merino ewe is fairly successful as regards the mutton, the cross is even more so in the fleece—the wool of the cross being comparatively dense, and of good quality.

The percentage of increase in this cross is high; this arises from the fecundity of the Romney Marsh, and also from the large supply of milk which the cross ewe gives—a characteristic of that breed.

The ewes of this cross are good mothers, and can be put either to the Lincoln or Border Leicester rams with fair prospect of success.

5. The Southdown and Merino Crosses.

The objection to the Shropshire crosses apply with still greater force to the Southdown as a sire, as the wool in that cross is lighter and more inferior, and the carcass also weighs less, but at the same time the quality and flavour of mutton is very high.

6. The Shropshire Down and the Merino Cross.

This makes an excellent butcher's sheep, as the carcass is short, compact, broad on the back and loin, round on the shoulder, and deep fleshed, while the mutton is of prime quality and flavour.

On good pastures these crosses do well, although in aptitude to fatten and early maturity—except while lambs,—they do not quite come up to the Lincoln or Leicester crosses; but the high character of the mutton makes up to a great extent for any shortcomings in these respects.

It is in the wool that this cross, like all the other down crosses, fails, although in a less degree than the others; and the deficiency in the weight and quality of the wool is so marked as to lead breeders to refrain from putting Shropshire rams to the Merino, except in special cases, or for a particular object, such as breeding for fat lambs for market, for which the Shropshire is peculiarly well adapted, the lambs of this cross coming early to maturity, being fair weights, and superior both as regards appearance and quality.

7. The Hampshire Downs and Merino Crosses.

These crosses have the advantage of large size, shapely carcass, and good mutton, but the fleece is very poor, both as regards quality and weight.

It is only right to notice that all the down breeds are noted for large percentage of lambs.

8. Changes of Breeding according as the Standard of Mutton or Wool requires to be raised.

Although in New Zealand owners as a rule use the different breeds of English sheep according to the class of country on which the sheep are kept, and according to the rules here mentioned, there frequently comes a time when they require to raise the standard of their flocks, either as regards their wool or mutton; and in such a case if it is the weight of the fleece that calls for increase, and the country on which the sheep are running is sound and good, the owner would, as a rule—whether his flocks are Border Leicester, Romney Marsh, or English Leicester, or any of the downs—most probably put Lincoln rams to his ewes; while, if it be the carcass which requires improving, it would, no doubt be the Border Leicester ram which would be used. For instance, if in the first cross with the Merino ewe the Border Leicester were used, the progeny would be comparatively light in the fleece, and if the whole of them, both ewes and wethers, are not to be fattened and killed, but some of the ewes kept to breed from, then the owner would put a Lincoln ram to these ewes once or twice, according to the nature of his country; and afterwards, perhaps, return to the Border Leicester or some other mutton sheep to maintain the character of his sheep for freezing and export.

With respect to the sheep which makes the most saleable mutton in the home market, it is believed that the first cross out of the Merino ewe by a ram of one of the English breeds (say), the Border Leicester, or the Shropshire or Southdown, would, both here and at home, sell the most readily and bring the best price. As to the most saleable weight again, that has altered very much, and in direction which gives us greater hopes of an improvement in the price of our Merino mutton in England; for while the sheep sold in London in 1882, which realised 6½d. per lb., averaged 80 lb., the most saleable weights have from that time gradually fallen till they now range from 55 lb. to 60 lb. This is a state of things which will suit our breeders well, as first crosses out of Merino ewes by English rams will, if fairly well cared for, reach the required weight at a much earlier age than the Merino now does.

The fact of the first cross being so saleable in the London market will suit our sheep-breeders, who are thinking of taking to cross-breeding, in another important respect, as it will enable them to put that system to the test in such a way as they will not run the risk of upsetting that which as breeders of Merinos they are now following, until they can see how the cross-breeding will answer. For they can for a few seasons put the English rams only to their old ewes, take the last crop of lambs as cross-breds, and if they think fit fatten off the whole of the progeny, or sell them as stores, or breed from them, according to the result.

This will answer well in yet another important respect. The English rams should be put to old and not to young ewes, as the losses in lambing with the English rams are much heavier when young, especially when maiden ewes are put to these rams.

XXII. Should Cross-breeding be adopted in this Colony; if so, where, and to what extent?

1. It should be Adopted.

As it is imperative that a remunerative outlet should be obtained for our surplus mutton, and as our sheep are almost all of the Merino breed, and that breed is not so suitable as cross-breds for the export trade, it is most essential that cross-breeding should be adopted in those portions of the colony where the climate, soil, and other surroundings are such as would—looking at the experience of New Zealand, and what has already been done in that way in this Colony—show a fair prospect of success. Besides this, the cross-bred wool is as a rule more saleable, and brings fully better prices than the Merino, so that it may be said both the cross-bred mutton and wool pay better than the Merino.

2. Where should it be Adopted?

(1.) *It should be so in portions of Colony similar to New Zealand in climate and soil.*

I will briefly indicate the portions of the colony where it is believed that cross-breeding can be successfully adopted. Taking it for granted, as I think I have a right to do, that where the soil is good, and the temperature and rainfall similar, which it really is, to that of New Zealand, it only requires the adoption of the New Zealand system of farming and sheep-breeding to make cross-breeding and fattening as successful in this Colony as in that.

(a) Comparison of the climate in this Colony with that in New Zealand.

The portions of this Colony to which I refer are New England (including the country from Uralla to Tenterfield), the higher portions of the Orange and Goulburn districts, and the Monaro and Tumut districts; and the following tabulated statement, which gives the temperature and rainfall of the places referred to in this Colony, and those of some of the principal districts in New Zealand, kindly furnished by Mr. H. C. Russell, the Government Astronomer, shows that this similarity actually exists.

The Mean Temperature and Mean Rainfall in portions of New Zealand and in portions of New South Wales.

Colony, and portions of Colony.	Temperature.	Rainfall.
NEW ZEALAND.		
Auckland (North Island)	59·5	41·799
Wellington do	55·6	50·117
Lincoln (Middle Island)	52·9	26·691
Dunedin do	50·7	35·246
NEW SOUTH WALES.		
Uralla	58·2	35·800
Glen Innes	58·4	35·600
Orange	54·8	38·950
Goulburn	56·3	26·750
Tumut...	58·5	37·730
Cooma...	53·7	19·800

From this statement it will be seen that there is very little difference, if any, in the temperature and rainfall of the portions of the two colonies mentioned; and I have Mr. Russell's opinion that it may be safely said that the climate of these places is similar for agricultural purposes.

(b) Comparison of the land in New Zealand with that in the more temperate portions of New South Wales.

While in the alluvial flats of the Hawkesbury, the Clarence, the Richmond, the Tweed, and other rivers, and in the very deep rich deposits of black soil on Liverpool Plains, and other parts of the colony, we have as good land in New South Wales as in New Zealand, or for that matter, perhaps, as any in the world, it may be that in the portions of this Colony in which the temperature and rainfall are best adapted for the growth of roots and cultivated grasses, we have very little, if any, country possessing the fertility of soil which characterises the very best portions of both the North and Middle Islands, where the system is followed; but while this is the case, there are considerable tracts of country in the districts named, with suitable temperature and rainfall in which the soil is of a superior character, yielding in many instances 30 to 40 bushels of wheat to the acre, which even in New Zealand would be considered first-class; and we have again in the portions of the colony alluded to, at least two, and perhaps three other grades of soils which would compare favourably with the second and third rate soils in

New Zealand, on which a rotation of grain and root crops and cultivated grasses is now successfully followed. For instance, taking New England we have—

(1.) The black volcanic soil with a strong tinge of red in it, giving, in favourable seasons, returns quite up to those stated, and frequently higher.

(2.) The less friable, but strong, somewhat black sod.

(3.) A sandy loam of a lighter or darker grey colour according to its fertility.

And it is believed that with proper tillage, and a little manure where required, or perhaps in some cases only lime, the least fertile of the classes of land mentioned, will when properly worked pay well under a rotation similar to that adopted in New Zealand.

Besides the portions of this Colony indicated as adapted for such a rotation as that followed in New Zealand, there are no doubt many other districts in which it will no doubt be adopted before many years are over.

(c) *The suitability of New Zealand system proved by actual experience.*

Having shown that there is in this Colony a large extent of country possessing similar climate and soil to those portions of New Zealand, where, under a proper rotation of crops, the owners are so successfully carrying on the breeding and fattening of cross-bred sheep—it is submitted that as this similarity exists, the same course can be followed in this Colony in the districts indicated; and on these grounds alone owners in these districts should have every confidence in giving the system a trial; but after all it is not necessary that they should rely solely on the New Zealand experience; for although a proper rotation of grain, root crops, and cultivated grasses has never been systematically tried in this Colony, sufficient has been done in growing turnips and grasses, more especially rye-grass and clover, to prove beyond all doubt that a rotation similar to that followed in New Zealand can be successfully adopted in the colder and more temperate portions of this Colony; and I make this statement not only on reliable information, which I have from time to time received, but also, so far as the growth of cultivated grasses are concerned, from what I actually saw last month in several parts of New England.

3. Cross-Breeding should be adopted on some of our Natural Pastures.

Although the return from cross-bred sheep kept on the natural pastures would neither be so large nor so early as under a system of root crops and cultivated grasses (while sheep that are kept under that system are sold as fat at twenty-two months, those depastured on natural grasses would have to be kept for, perhaps, six or eight months longer), there is no doubt but that cross-breeding can be successfully followed in the best portions of that part of the colony known as the Western Slopes—including the lower-lying, hilly, and undulating thickly-grassed country on the west side of the Main Coast Range, commencing at the line where the New Zealand system of sheep-farming and tillage cannot be successfully adopted in this Colony, and extending westward from the mountains to the plains. But the country in which cross-breds will thrive has a wider area than that. This has been proved by the fact that a good many owners have of late years been breeding

and fattening cross-breds successfully on the natural grasses in portions of the colony where the climate is warm, the rainfall light, and where it was considered cross-breds would not answer.

The country I allude to is such as that extending from (say) Inverell to Moree, from Liverpool Plains to Wee Waa, from Dubbo to Warren, from Cowra to Forbes, from Wagga Wagga to Groongal, and from Corowa to Moama. The fact is, that if the land is good, the pasture plentiful and nutritious, the water supply sufficient, and the breeder knows his business, cross-breds do well in even comparatively warm country.

All these conditions are called for in the case of any kind of sheep, if they are to give good returns, but especially so as regards cross-breds; and although it may not appear a matter of very great moment, the water supply is with them of special importance; for even in the temperate and colder portions of the colony cross-breds require a great deal of water, and not only so, but they must not be made to travel far for it if they are to lay on condition as fast as they ought to do; while, however, this is the case, with plenty of water they can come through a drought nearly as well as the Merino, and with the return of good seasons and sufficient grass, if the land is good, they lay on condition faster than the Merino. At the same time the safer course would be to only breed cross-breds in the more temperate and colder portions of the colony.

Then again, the fencing ought to be thoroughly secure. It should be cross-bred proof from the commencement. If cross-breds are once allowed to get through a fence it will be next to impossible afterwards to keep them within bounds.

As already said, nothing less than an eight-wire fence with one batten between, if the posts be no more than 8ft. apart; and with two if they are 12 ft. or even 10 ft. apart.

Of course in the portions of the colony here indicated, although root crops and cultivated grasses usually sown in New Zealand cannot be grown, lucerne can be so where the soil is suitable (and it is so in a great deal of the country here indicated), to great advantage, and would in that case to a large extent supply the place of the root crops and cultivated grasses and clover grown in New Zealand; for not only does lucerne in suitabe soil produce as much, if not more, hay of excellent quality than rye-grass and clover per acre, but it can with ordinary care be successfully pastured with sheep; and if the land is really good and the crop an average one, the owner, by dividing the sheep into small flocks—making the paddocks small—and regularly shifting the sheep before the lucerne is too much eaten down, as many as eight, ten, and even twelve sheep can be fattened to the acre. This is very encouraging and is still more so when it is considered that the area within which lucerne can be successfully grown has recently been proved by actual experience to be much more extensive than was supposed.

Many owners are now growing lucerne successfully on land which has little of the character of alluvial about it.

4. Under what circumstances should cross-breeding be adopted?

As both the cross-bred mutton and cross-bred wool bring better prices than the Merino, the answer to this question, I think, is that those owners who are in the position to do so should introduce English sheep into their

flocks; but before deciding on making this change they should fully satisfy themselves that they are in every respect in that position by ascertaining:—

(*a*) Whether the climate, *i.e.*, the temperature and rainfall of the locality in which their land is situated are suitable for the breeding of cross-breds.

The great importance of this question is so palpable as to need nothing to be said in urging owners to give it full and careful consideration, whether the question be raised as regards land which it is proposed to prepare for cultivation for the keeping, breeding, and fattening of cross-bred sheep, or as regards country on which it it is intended to keep that description of sheep on the natural grasses.

(*b*) Whether their land, if intended to be cultivated, is so situated and of such quality as that it will grow root crops and cultivated grasses sufficiently well to carry and fatten the larger-framed cross-bred, and whether they have both the means and the practical knowledge which will enable them to cultivate the land properly.

These questions call for careful consideration, for if the land is not good or otherwise unsuitable for the crop which is to be grown, or those attempting to lay it down have not the necessary practical knowledge, the result will be a failure and the labour and expense will be lost.

(*c*) If owners are thinking of taking to cross-breeding on the natural pastures, they should consider whether their land is such as will enable them to rely upon having a full supply of nutritious grass such as the larger sheep require, to give a satisfactory increase and a paying cast of fat sheep.

In deciding this question owners should bear in mind that the sheep they are thinking of introducing are larger framed and much less inclined to travel far for their food than the Merino, and that they need a full and nutritious bite if they are to be kept improving and come early to market.

(*d*) Whether their holdings are sufficiently well watered for cross-bred sheep. As already pointed out, a great deal of the success with cross-breds depends upon the water supply being full and convenient, and where this cannot be insured owners should be cautious in taking to cross-breeding, especially where the climate is hot and the feed frequently dry.

(*e*) Whether their fences are such as will be certain to keep the cross-breds in their proper paddocks.

Although it may not appear a very important matter, this decidedly is so. Unless the fences are thoroughly cross-bred proof the introduction of the English sheep will not prove a success, for not only will the sheep go all over the owner's own holding and in the crops, and their proper management will be next to impossible, but they will be constantly trespassing on his neighbours' land and in their crops.

This was the result of bad fences some ten or twelve years ago when there were a good many cross-breds in the colony, and the consequence was that, as owners could not keep these sheep in the paddocks in which they were placed, the cross-breds were got rid of and Merinos purchased in their place.

Then there is still another matter for consideration. Owners in South America have for some years been and still are introducing large numbers of English sheep, and the result already is that a great deal of mutton was sent from that country to the home markets, and during the greater part of last year brought higher prices than the Australian, from the fact that a large portion of the mutton was cross-bred. There is little doubt, too, considering the style of management by South American sheep-breeders, and the heavy carrying capacity of the pasture there, that they give more attention to mutton than wool, and that they will continue to introduce English sheep, so that we may expect a heavy increase both in cross-bred mutton and cross-bred wool from South America.

There is another matter which those owners who are thinking of trying cross-breeding should consider. It is the effect which the change from the Merino to cross-breds will, if it be as largely adopted as may fairly be expected, have on the price of cross-bred wool and mutton, for it is scarcely to be expected that if (say) double the quantity of that description of wool were put on the market—large and general though the demand for it may be—the price for it would be maintained, whatever effect the increased production might have on that of the mutton.

XXIII. Which of the Breeds of English Sheep should Owners in this Colony use for Crossing.

The information already given as regards what breeders are doing in New Zealand, and the extent to which the different crosses have proved successful there, and the circumstances under which they have done so, will enable those owners in this Colony who are thinking of trying cross-breeding to obtain a fairly correct idea of the value of the different English breeds, and the description of country and its surroundings on which the different breeds should be used. It is, however, I believe, possible to put the information in a still clearer and more concise shape, by estimating the relative values of the points which the best breeds possess, setting these out in a tabulated form, and testing the several crosses accordingly, on these points, for although the points and their values may not be quite correctly given, the form would assist owners in arriving at a decision as to which English rams they should try more readily and satisfactorily than they could from the information furnished in the usual way.

The tabulated statement given below is therefore submitted for consideration on the understanding that both the points and the relative values assigned to them are put forward only as tentative, and solely for the object stated.

It is to be understood, also, that the pasture on which the crosses are kept when making the marks appearing in the statement is good, but not of the very best quality. If it were of the very best quality then all the crosses would stand better than they appear to do in the statement, but the Lincoln would in that case come closer to, if it did not take the lead; while, again, if the land was only middling, that cross would show less favourably than it now does, and the Border Leicester and English Leicester, with the Southdown, proportionately better; and if the land is wet the relative position of the Romney Marsh would be a good deal better than that of any of the other crosses.

The following is the tabulated statement referred to:—

Statement showing the views of Breeders in New Zealand as to the relative values of the different English sheep for crossing.

The Breed of sheep.	Aptitude to fatten.	Hardiness and soundness.		Lambing and Increase.	Form and Shapes.	The Mutton.			The Fleece.		Suitability for crossing.	Total.
		Constitution.	On feet.			Appearance.	Quality.	Weight.	Weight.	Quality.		
	7	8	5	6	12	3	7	6	20	20	6	100
The Lincoln	6	4	3	4	11	2	5	6	20	18	5	84
The Border Leicester ..	7	6	4	5	12	2	6	4	17	19	6	88
The English Leicester...	7	5	3	5	10	1	4	3	17	18	4	77
The Romney Marsh ...	5	7	5	6	11	2	5	4	17	14	5	81
The Shropshire Downs	6	6	3	6	12	3	7	3	14	12	3	75
The South Downs ...	6	5	3	5	12	3	7	2	12	11	2	68
The Hampshire Downs	6	5	3	5	11	2	6	8	12	12	2	72

Synopsis of Paper on Stock Breeding and Fattening in New Zealand.

I.—Scope and object of the report.

II.—Extent and area of the colony:—The North Island, the Middle Island.

III.—The Physical features of the colony:—The North Island, the Middle Island—its Northern portion, its Middle portion, its Southern portion.

IV.—The climate and rainfall of New Zealand:—The North Island, the Middle Island.

V.—The land in New Zealand and its suitability for tillage and grazing:—The North Island, the Middle Island; total area available for tillage and grazing.

VI.—Fencing in New Zealand.

VII.—Agricultural seasons.

VIII.—Rotation of crops.

IX.—Cultivation of the land by contract.

X.—Capability of the land under rotation.

XI.—Grasses and clovers.

XII.—The mixtures of grasses and clovers usually sown.

XIII.—The grasses sown in New Zealand:—1, perennial rye-grass; 2, cocksfoot; 3, Timothy; 4, crested dogstail; 5, meadow fescue.

XIV.—The clovers sown in New Zealand:—1, perennial white clover; 2, red clover; 3, cow-grass, or perennial red clover; 4, alsike; 5, lucerne.

XV.—Laying down grass and clover seeds in New Zealand:—1, on fern land; 2, on bush; 3, on tea-tree.

XVI.—Laying down land which has been cultivated with grass and clover seeds:—1, preparation of the land; 2, when the seeds are sown; 3, how they are sown.

XVII.—Root crops:—1, turnips—(1) turnips growing on tussock (new) land, (2) turnips growing on cultivated land, (3) catch crops of turnips; 2, mangols.

XVIII.—Green and catch crops:—1, rape; 2, oats; 3, rye; 4, wheat; 5, Cape barley.

XIX.—The number and distribution of sheep in New Zealand:—1, the number; 2, the breeds represented; 3, their distribution.

XX.—The description of the different breeds of English sheep:—1, the Lincoln; 2, the Border Leicester; 3, the English Leicester; 4, the Romney Marsh; 5, the Southdown; 6, the Shropshire Down; 7, the Hampshire Down.

XXI.—Views of New Zealand breeders on the fitness of the several breeds of English sheep for crossing:—1, the Lincoln and Merino crosses; 2, the Border Leicester and Merino crosses; 3, the English Leicester and Merino crosses; 4, the Romney Marsh and Merino crosses; 5, the Southdown and Merino crosses; 6, the Shropshire Down and merino crosses; 7, the Hampshire Down and Merino crosses; 8, Changes of breeds according as the standard of mutton or wool requires to be raised.

XXII.—Should cross-breeding be adopted in this Colony; if so, where, and to what extent should it be so? (1) In the portions of the colony similar in climate and soil to New Zealand. (2) On some of our pasture land. (3) Under what circumstances should cross-breeding be adopted?

XXIII.—Which of the breeds of English sheep should be used?

Dropping after Calving.

There is certainly no disease of a more non-contagious character that causes greater loss to cow-keepers, particularly to those engaged in dairying, than the above-mentioned one. "Milk fever" is the name by which it is usually spoken of, but it is a very unhappy title, as it leads to the impression that the disease is characterised by fever, which is really not the case, as the temperature is in many cases lowered beneath the normal standard. Professional men usually speak of this disease by the name of "parturient apoplexy." It is a malady peculiar to the cow, and occurs within a day to three or four days after calving, occasionally taking place before that act. Cows that are heavy milkers are most prone to this trouble; hence its prevalence amongst the improved milking breeds, and its almost entire absence in those breeds cultivated as beef producers. Not until a cow has had several calves is she so evidently predisposed to this disorder, her susceptibility seeming to increase in direct ratio to the abundance of her flow of milk. It requires no lengthened experience to enable an ordinary observer to discriminate between the significance of the symptoms of the disease under consideration and any other known bovine disorder, for they are pretty regular in their course, and decidedly marked in character. One peculiarity is the suddenness of the outset. The first, but least definite premonitory indication is the greatly reduced quantity of milk given. The subject has a wild expression of the eyes, and there is occasionally a shaking of the head. The movements of the hind legs become irregular, and they are jerked up repeatedly. When an attempt is made to move, the quarters sway from side to side, and there is more or less knuckling at the fetlocks. Those paralytic symptoms increase rapidly in severity until the cow staggers and falls, the power of voluntary movement being altogether suspended in most cases. Occasionally, after falling the patient has power enough to enable it to partially or completely rise. In some instances, or when the attack is a mild one, paralysis is never complete, and the suffering animal may occasionally, with difficulty, rise, or, if there is inability to accomplish this, the head may be held up in a natural manner, and not spasmodically turned and held towards one of the shoulders, as is usually the case in a pronounced attack. If the patient is left to herself she is likely to lose power to even lie naturally upon the breast bone, but becomes prostrated on her side, lying outstretched, which position is very unfavourable, and causes aggravation of the disease.

The London *Agricultural Gazette*, in a recent issue, calls attention to the hydrate of chloral treatment for milk fever after calving, saying that it is coming to be regarded as almost a specific for the disease. From 6 to 8 drachms of chloral hydrate mixed with molasses are given as a first dose, and ½ oz. at each succeeding dose, at intervals of two, four, or six hours, according to the severity of the symptoms and the size of the animal. If treatment begins at the first, or early part of the second stage, the number of doses necessary rarely exceeds two.

The bowels are always inactive, and there is inability in many cases to void urine. Gas is occasionally noticed to form on the stomach, the belly becoming drumlike. The pupils of the eyes are dilated, giving those organs a glassy appearance, and they lose common sensibility, so that the finger can be run against them without causing any obvious pain. The pulsations are not at first raised much above the normal, which is forty to fifty beats to the minute, but the pulse is full and soft, and as the stupefaction increases becomes more frequent, small, and weak. In fatal cases, which are very common, fully from forty to fifty per cent. succumbing, death may take place in twelve hours, but usually does not occur before the twenty-fourth, or forty-eighth, some patients lasting three days. Although the disease is remarkable for the abrupt manner in which it sets in, it is no less so for the hasty manner in which recovery occurs in some cases, and in many instances when it is least expected. When the result is thus favourable, the first encouraging signs are the opening of the eyelids, some movement of the eyeballs, and an apparent return of sensibility to them. The head will occasionally be held in its natural position, and, as the coma rapidly passes away, it will be continually suspended. There may be every symptom of returned consciousness, but the patient may continue to lie until something excites it, when it will jump to its feet and seem almost as well as ever. The period during which the drowsiness passes off varies, but it is usually not more than an hour or two.

In some cases, after the stupor has passed away, symptoms of inflammation of the lungs are noticeable, due to the fluids that have been poured into the mouth; and as there is inability on the part of the patient suffering from this disease to swallow, the fluids may pass into the windpipe, and thence to the lungs, producing irritation and inflammation. Another unfavourable sequel of "dropping after calving" is the continuance of paralysis, as shown by inability to rise or stand after all dullness has passed away. In treating of the disease we are considering the most important feature of it, for there is no doubt that proper treatment is in no small measure capable of preventing it. It has been already stated that heavy milking breeds are most prone to this malady, so that we must look upon this disease as being intimately connected with or dependent upon the activity of the milk glands, and that activity constitutes a predisposing cause of this trouble.

Full-bloodedness is one of the most important preventable causes, and is brought about by heavy feeding immediately prior to calving. The blood that has gone to sustain the calf is abruptly thrown into the circulation of the mother as soon as birth is effected; thus repletion must follow great fullness.

When feeding is steadily liberal during the time the calf is carried, it is not found to be so dangerous as when a plentiful diet is substituted for a spare one a short time before delivery. Insufficiency of exercise is, no doubt, a cause, for amongst dairy cows that are much confined and well fed the disease is particularly prevalent; markedly more so than when heavy milkers have to exert themselves, as they do in pasturing on hilly land, under which conditions this trouble is proportionately rare. Exposure to heat or cold will, in a cow predisposed, exert an exciting influence in producing this trouble.

Nature.

The observations and investigations in regard to the nature of this disease have been numerous, and although there are some points not entirely cleared up, still we know enough of the malady to be certain that the brain is the

seat of trouble, and that the disorder in connection with this organ is due to the modified character of the circulation; hence the general use of the designation "parturient apoplexy."

The conditions found on examining the brain, *post mortem*, vary. In some cases no marked change can be detected, except that the organ seems more than usually bloodless, which is no doubt the case, and the derangement then occurs from the insufficient blood supply. At other times the vessels are found to be very full, or the fluid portion of the blood has passed through their coats, appearing as a straw-coloured fluid in the brain substances. These latter conditions impair the function of the organ by pressure on its substance. A feature worthy of notice in connection with this disease is that it never occurs after a prolonged or difficult birth, but usually follows when delivery has been accomplished with the greatest ease.

Prevention.

Considering the innate tendency there is in good milkers to the development of this disease, and the impossibility of foretelling with any certainty what subject it may attack, it behoves the managers of cows to feed them so as to reduce as much as possible their liability, in so far as full-bloodedness (plethora) is concerned.

Pregnant cows should be liberally fed at all times; but when the critical period of birth-giving is near at hand some caution must be exercised, and by simply allowing a moderate quantity of hay and water for a few days after birth, other casualties besides the one under consideration may be averted. Half a pail of bran mash may, in addition, with benefit, be given three times a day. Very frequently we find just the opposite course pursued, and meagre fare throughout frequently substituted by a liberal diet on the approach of parturition, and after that act. In speaking of the causes, want of exercise was instanced as a predisposing one, so that there is no doubt a certain amount of movement should be allowed.

Heavy milkers in high condition—high condition does not necessarily mean fatness—or, in other words, predisposed subjects, we are of the opinion are benefited by the administration of mild purge, as 1½ lb. of Epsom salts dissolved in water and given in one dose immediately after calving. Although proper caution will very materially lessen the losses from this disease, it is questionable if the greatest care could obviate every case, so strong is the predisposition in some subjects.

Treatment.

The most intelligent and assiduous efforts to cure this disease often result in disappointment; but, on the other hand, some very hopeless cases make rapid and satisfactory recoveries. A simple course of treatment we have found the most successful. When the attack is just setting in, and before the power to stand is lost, bleeding is decidedly advisable. This should be followed by the administration of a purge, as 1 lb. of Epsom salts dissolved in a quart of water, with a drachm of croton oil mixed. When the ability to stand is lost the purge mentioned should be given, but much care should be exercised in giving it, as the patient will at this stage have partially or completely lost the power of swallowing, so that there is much danger of the fluid going down the windpipe into the lungs, and either immediately smothering the animal or causing inflammation of those organs. The safer way is to pass the hose of an injection pump into the stomach and pump the fluid down, or else pass a probang and pour the fluid through

it. If any power of voluntary movement is still retained, drenching is frequently accomplished without any bad results, but it must be done cautiously, only a small amount being poured into the mouth at a time. In our opinion, no more medicine is necessary, for in addition to the risk of giving it, we have found no benefit accrue; but there is other treatment of even more importance than medication, and the first step in it is attending to the position in which the sufferer must be forced to lie. The tendency of the cow to stretch herself out on her side has been alluded to as unavoidable to her chance of recovery, so this must be controlled, which is best effected by wedging the patient up well with bags stuffed with straw, so that she may be forced to lie on her breast bone. The head should also be kept elevated to some extent by a bag or two of straw. The body ought to be kept warm with blankets, and we have found that when copious sweating has been produced through their agency it had a salutary effect. We also attach much importance to the application of ice to the head, which is easily done by breaking some of it up, wrapping it in a cloth, and placing it immediately behind the horns, with the ends of the cloth brought in front and tied.

The purgative will be aided in its action by injecting soaped water into the bowels every hour or so. In some cases the bladder becomes much distended with urine, and the patient has not the power to void it. This condition can be readily detected by passing the hand into the bowel and feeling for the bladder beneath it. If it is found full, moderate pressure will usually cause its expulsion; but if this is not successful, the hand should be passed into the passage leading to the womb, and on its floor, about 4 inches from the entrance, will be found the opening of the canal leading to the bladder, which is covered by a thin fold of membrane that requires to be raised before the finger can be forced into the canal. The channel being thus distended will encourage the flow of urine. If the belly becomes distended on the left side from the giving off of gas in the stomach, the trocar and canula should be used to draw it off, and, if this instrument is not at hand, a penknife will do to make an opening, in which a quill may be held, to allow the gas to escape through. The treatment of "dropping after calving" requires much vigilance, and it is only the persevering nurse that will be successful, and have the satisfaction of witnessing a recovery. Either recovery or death will soon occur to relieve the anxiety of the attendant.—Dr. F. C. Grenside, in *Canadian Live Stock Journal.*

Report on a visit to the Clarence River District for the purpose of ascertaining the nature and extent of Insect Ravages in the Sugar-cane Crops.

By A. SIDNEY OLLIFF,
Government Entomologist, New South Wales.

Entomologist's Branch, Department of Agriculture,
Sir, Sydney, 30th March, 1893.

I have the honour to submit herewith my report on the results of an inquiry, undertaken by your instructions, into the nature and extent of insect ravages in the sugar-cane crops on the Clarence River. Some delay has occurred in submitting the Report, from the fact that the inquiry entailed the preparation and examination of a large number of specimens; but this delay was to be anticipated, owing to the circumstance that the bulk of the insects dealt with proved to be little known or undescribed.

I would beg to be permitted to thank Mr. E. W. Knox, the General Manager of the Colonial Sugar and Refining Company, for providing me with a recommendation to Mr. C. N. Stephens, the manager of the Company's mill at Harwood, and to acknowledge the kind assistance of Messrs. A. C. Barry, Anderson, Kirk, and A. Garven; and, finally, to express my indebtedness to Mr. E. de P. O'Kelly, of the Department of Agriculture, for his willing help during the progress of my work.

I have, &c.,
A. Sidney Olliff.

I. Introductory.

The results and observations offered in this report—the outcome of a visit to the Clarence River, in December and January, extending over a little more than a fortnight, and made by direction of the Hon. the Minister for Mines and Agriculture—prove, I think, conclusively, that the disease which has lately prevailed amongst sugar-cane in the Clarence River District is not due to the attacks of insects. That certain of the insects afterwards referred to are doing some amount of damage is assuredly a fact, and I have endeavoured to indicate the particular insects which do this damage, and to point out the best remedies and preventives for their attacks; but I am desirous, at the very beginning, to make it clear that I regard my observations as purely negative evidence in regard to the disease itself. Large patches of cane in many cane-fields on the Clarence River are suffering from some disorder, but many of these diseased patches proved,

upon careful examination, to be free from any attack by insects. The diseased patches were clearly noticeable from a considerable distance, being discoloured and exceedingly poor in growth. I found a considerable number of canes attacked by fungi, not only on the leaves and stalks, but also within the leaf-sheathes near the node, and even within the stalks themselves. I believe several fungi—more than one of them quite recently made known—have been discovered on sugar-cane; but it must be obvious to anyone who realises the very diverse and complicated structures and life-histories of microscopic fungi, that only a competent student of the group could give us the facts we require regarding their identity and manner of living and propagating. In these days of progress, to assert that this cane disease—or, indeed, any plant disease—is due to the attacks of an "insect" or a "fungus" is not sufficient; we should know not only what fungus or insect is the cause of the disorder, but also something of its mode of life and development.

Although I have no pretensions to rank myself with those who have made it their business to grow sugar-cane, and am, therefore, very diffident about expressing an opinion outside my own province, I feel bound to add that I am convinced that a large amount of the present trouble is due to continued in-growing of stock. By this I mean the continual planting, season after season, of "sets" or "ratoons" from the same parent plants, a process which must necessarily result in deterioration and decay. Let the cane-grower renew his stock from time to time from new localities, choosing, of course, a suitable variety, and taking every precaution as regards disinfection, and I think he will find an immediate benefit—a benefit which will make itself manifest within a season or two. Draining and rotation of crops, I need not allude to, as they are the distinct province of the practical agriculturist, but I should like to point out the desirability—nay, indeed, the necessity—of a thorough examination of the diseased canes by a competent mycologist.

II. Insects observed on the Clarence River.

The Sugar-cane Moth Borer (*Nonagria exitiosa*, Oll.)

Plate XXII, figs. E, F, G.

This is undoubtedly by far the most destructive of the insect pests that attack sugar-cane in New South Wales, and I am inclined to think that injuries caused by this species have frequently been mistaken for the work of another and much more generally distributed cane-pest, the ***Diatræa saccharalis***, Fabr., a very different moth, which, in its larval state, is known to burrow into sugar-cane, in many localities both in the new and old world. I have had opportunities of examining sugar-cane affected with borers from the Clarence, Richmond, and Tweed Rivers in New South Wales, and from Mackay in Queensland, and in each case the borer has proved to be the Noctuid moth here described under the name ***Nonagria exitiosa.*** The identity of the insect was established by breeding the moths in confinement, so there is no room for doubt on this point. In many instances where the presence of the borer has been recorded in Australia, only the larva or caterpillar has been examined, and no attempt has been made to breed the perfect insect. Under these circumstances it is obvious that the statements as to the occurrence of the better known moth-borer—***Diatræa saccharalis***—in this country must be received with extreme caution, particularly as they have mostly been made by observers who are not familiar with the characters of the insects under discussion. In all probability the ***Diatræa***, or West Indian

cane-borer, as it is frequently called, does occur in our cane-fields, for it is a very widely-distributed and abundant insect, being found in such remote localities as the East and West Indies, Mauritius, British Guiana, and the United States; but before its presence with us can be considered as definitely settled, it will be necessary to obtain specimens of the perfect insect, or to obtain the opinion of some entomologist as to the identity of any caterpillars or borers that may be found. It is to be hoped that cane-growers whose crops are affected by these insects, will interest themselves in this matter, and forward specimens of the pests for examination to someone competent to give a decisive opinion.

The borer, *Nonagria exitiosa*, is undoubtedly most destructive wherever it occurs, not only killing young canes, but also doing great injury to strongly-grown and even mature plants—that is to say, canes up to the age of fifteen months or even two years. Fortunately, however, this borer is by no means abundant in the plantations of the Clarence River, and as is always the case when the pest is not very plentiful, the damage is chiefly confined to the outside and more exposed rows of cane. The exact method adopted by this pest in laying its eggs, and the position in which they are placed, has not, as far as I am aware, been observed in a state of nature, but two moths, which I bred in confinement, deposited eggs singly on the leaves of the young canes that had been their homes, a fact that is almost sufficient to show that the natural habit of the insect is to lay a solitary egg here and there on the canes, probably not more than one or two on a single stalk. As the eggs laid by the moths alluded to were not fertile, it is not possible to give the period required for hatching, but this would probably vary at different seasons and in different climates; but it is clear, from repeated examinations of large numbers of affected canes, that the young borers or caterpillars quickly eat their way into the inner and more juicy portions of the plants. They do this with indifference, in the top, the node, or the main stem, and, as a rule, only one borer is found in a cane. Sometimes two or even three distinct burrows or tracks may be found in one cane, more commonly in canes of nine months' growth or upwards, but this usually only indicates that the borer has made its way out from the original burrow, and made a new home, or successive new homes, for itself. In one or two instances I have found two borers in the same stalk of cane, but from the rarity of this occurrence I conclude that it is exceptional. It is, however, no uncommon thing for the borer to desert the cane in which it had its first home for a fresh one, and this change of abode is not confined to any particular period of the caterpillar's life, and, judging from the relative size of the deserted burrows, may take place at any stage of its existence. The causes that lead to these wanderings, which, it may be remarked, chiefly take place when the borers are living in young cane, appear to be the drying and shrinking incident to the death of the cane-tops, and the decay and fermentation set up by the wounds that result from the operations of the borers themselves. The burrows are seldom very extensive, being usually not more than 6 or 8 inches in length, and very frequently much less, but their actual length is made up for by their girth, the caterpillar having the habit of eating the inner walls of its burrow, and thus forming a chamber in the centre of the stalk [*See* Plate XXII, fig. K.] Very often the caterpillar eats its way just beneath the surface of the outer leaves of the cane-top, either partially or completely ringbarking the plant, so to speak [*See* Plate XXII, fig. L.] When fully grown, and about to pupate—*i.e.*, transform to the chrysalis stage—the caterpillars make their way to near the outer edge of their burrow, and either make a new orifice or enlarge an old one. The pupa or chrysalis is found

a short distance within this opening, which serves as a means of exit for the moth when it developes. The time required for the caterpillar to attain maturity has not been ascertained, and observations on this point would be very interesting. The duration of the pupal stage averages about ten days in the summer months, but occasionally it is much shorter, as a caterpillar obtained by me in December turned to a pupa on 2nd February, and to a moth five days later. From the fact that I have on various occasions succeeded in breeding this moth from caterpillars obtained on the Clarence River, on dates varying from 16th July, 1892, to 2nd February, 1893, and that the progeny of the last named would have ample time in the mild climate of our northern rivers to attain full development and pupate before the winter sets in, I am of opinion that three, if not four, distinct broods of this moth make their appearance every year; and this would be no very singular fact, as several Noctuid moths are known to be equally prolific in this country. The evidence in favour of the maize moth (*Heliothris armiger*, Hübn.) being four-brooded in New South Wales is very strong. Indeed some moths, chiefly those which feed on a large variety of food-plants, seem to breed all the year round in the warmer parts of the country, generation succeeding generation without a break.

After careful observation, I have convinced myself that one of the chief, if not the chief, reason that the *Nonagria* has not spread more widely, and done more damage on the Clarence, is the fact that two minute and highly interesting parasites are present in such numbers as to keep it within reasonable limits. These parasites both belong to the *Hymenoptera*, the order of insects that includes the ant, the bee, and the wasp; but, although pertaining to the same order, they belong to very different families, and differ greatly in habits.

The most abundant of these parasites is a member of the large family of *Ichneumonidæ*, a group composed of four-winged flies that live, in their early stages, at the expense, and within the bodies of, the caterpillars of butterflies and moths, the grubs of beetles, and other insects. The particular species under discussion, which it is proposed to call *Apanteles nonagriæ* (Plate XXII, fig. H.) is a very small black fly, measuring only a little more than a twelfth of an inch in length, with reddish-yellow legs. The mother fly pierces the skin of the *Nonagria*-caterpillar by means of her sharp ovipositor, and lays eggs within its body to the number of fifty or sixty. These, upon hatching, feed upon the softer tissues of the caterpillar, avoiding the vital parts. When full grown they make their way out of their victim, which dies either just before or just after the emergence, and spin white silken cocoons preparatory to changing to the chrysalis or pupa stage. These cocoons are massed together, and are usually found in the burrow in which, but for the presence of these enemies, the caterpillar would have passed through its own transformations. As a general rule, not more than a week is spent in the larval condition, but the period varies with the season, and in one instance I have known, the period extended to twenty days. This was in August, and no less than ninety-two of the cocoons were counted on the dead remains of an individual *Nonagria* caterpillar.

The second parasite (Plate XXII, fig. I) is an exceedingly small insect, about half the size of the species just referred to, and belongs to the family *Chalcididæ*. This also appears to be a species hitherto unnoticed by entomologists, and it is proposed to call it *Euplectus Howardi*. This insect attacks and lays its eggs in the chrysalis of the *Nonagria*, in place of the caterpillar, and it appears to be an equally effective enemy of the cane pest. I have myself only once bred this smaller parasite, and have had but limited

opportunities of observing its habits. Eight or nine specimens was the number bred by me, and they emerged from small cocoons, enclosed within the chrysalis of the moth. Mr. Koebele* bred this parasite in January, 1891; and, in a brief report on a trip to the Clarence River, he states that the parasites pupate both within and without the chrysalis of the moth-borer, and that when they emerge, very few holes for egress are made in the latter, a single one often being sufficient for all. He also says, "A few hundred may be bred from the chrysalis of the cane-borer, and as the life-history, as far as is known, is of short duration, this parasite is nearly, if not wholly, as valuable as the first"—here called *Apanteles nonagriæ*—"in keeping the borers down." I may add that the larger parasite has been obtained by Mr. J. A. Despeissis on the Richmond River, and both species, I am informed, were bred by Mr. M. H. Samson, at Harwood, on the Clarence.

A Fungus-eating Beetle. (*Brachypeplus binotatus*, Murr.)

Plate XXII, figs. A, B.

The next insect that we have to consider, is a small and very flat. dark brown beetle belonging to the Clavicorn series, which I consider to be the species known as *Brachypeplus binotatus*, Murray, (Pl. XXII, fig. A). This is a typical member of the family *Nitidulidæ*, and has brownish-red antennæ and legs, and the elytra, or wing-cases—which are abbreviated behind, leaving the abdominal segments exposed—are provided with a deep orange-coloured band, interrupted at the suture by a space as broad as the scutellum. This insect has been accused of doing great injury to the cane in its larva or grub state, by boring into the tops and stalks, and especially into the young buds. As this habit is greatly at variance with what is known of the bulk of the family *Nitidulidæ*, which are nearly all scavengers, living on decaying matter, both animal and vegetable, I was at considerable pains to observe its transformations and habits as closely as possible. I found that the larva (Plate XXII, fig. B), a small yellowish creature, was invariably associated with certain fungi upon those portions of the cane where decay and fermentation had already set in, and that they did not occur on healthy cane. The beetles themselves were found on all portions of the cane, and on other plants, although they were most abundant on decaying cane-tops, and between cane leaves attacked by fungi, but this wandering propensity is only what we might expect, as the chief object of the insect's existence in the adult stage is the reproduction of its kind. Moreover, they are provided with ample wings, and can readily move from place to place. The larvæ, however, are very sluggish in their movements, and are only found on those parts of the cane that are hidden from the light. In order to ascertain if these minute insects really feed on the decaying tissues of the plant, and the accompanying fungi, I kept a number of them confined in small glass vessels, and provided them daily with small portions of decaying cane affected with the fungi, with the result that I succeeded in bringing them to maturity in ten days from the time of their capture. As regards the duration of the larval stage, this observation proves nothing, as the larvæ were about two-thirds grown, when they were first confined, but I think it may be taken as conclusive evidence that the larva feeds on decaying tissue

* "Insect Life," vol. iv, p. 385.—Washington, 1892.

and fungi only, as no tracks or burrows were seen in the cane-tops or leaves, although very careful search was made for any mites or other small insects that might possibly form a means of subsistence to the *Brachypeplus*-larva, before the food was placed in the glass vessels. The larva having reached full growth, turned to a pupa in any convenient shelter, such as the base of the leaves or other sheltered portions of the plant, and a few days afterwards, the adult insect, or beetle, made its appearance. From these observations, which were repeatedly made, it is clear that *Brachypeplus* is not a cane-borer, and that it merely feeds on the diseased tissues of the plants. This is in accord with what is known of the habits of the bulk of the family, as will be seen from the following observations of the late Mr. Andrew Murray, the author of an elaborate monograph on the *Nitidulidæ*. Murray writes:—"The chief function of this family is that of scavengers. Their main business is to clear off decaying substances from the face of the earth, especially those minute and neglected portions which have escaped the attention of other scavengers, whose operations are conducted on a larger scale. We may characterise them in one point of view as retail scavengers They are, so to speak, users up of waste materials. After the beast of prey has satisfied his hunger on the beast he has slain, after the hyæna and the vulture have gorged themselves on its carrion; after the fly, with its army of maggots, has consumed the soft parts; after the burying-beetle and the *Silphidæ* have borne their part in the clearing away, and when nought but bones remain, then come the *Nitidulidæ* to go over what they have left, to gnaw off every fragment of ligament or tendon, and to leave the bones as nearly in the state of phosphate of lime as external treatment can. In another point of view, however, their employment is wholesale and wide enough. They conduct their operations all over the world; their branches extend into the most remote districts; the materials with which they have to do, although mere waste, have no other limit to their variety, or their number, than the organised substances found on the surface of the globe. As in all great establishments, too, the principle of division of labour is carried to a great extent. Each different kind of substance has a different member of the firm told off to take charge of it. One species confines itself to rotten oranges, another to bones, a third to putrid fungi, a fourth to decaying figs. Decaying wood, decaying bark, decaying flowers, decaying leaves, all furnish distinct employment to different species."*

A PREDATORY BEETLE (*Cryptamorpha Desjardinsii*, Guerin.)

Plate XXII, figs. C, D.

ANOTHER insect was commonly found in company with the *Brachypeplus*, namely, a small reddish-brown beetle, with a black marking on the elytra, known as *Cryptamorpha Desjardinsii*, Guerin (Plate XXII, fig. C.) This species was also observed in captivity, and it was found to prey in its larval condition on any small insects that might come in its way. Mites or *Acari*, the young larvæ of *Brachypeplus*, small *Thysanura*, and other minute insects, were equally relished by this voracious larva It is a very active and restless creature, and evidently does a useful work by devouring destructive mites and other minute insects which live upon the cane. The larva of this insect was constantly found in company with the larva of *Brachypeplus*,

* Trans. Linn. Soc., London, Vol. XXIV, p. 227 (1864.)

but it was not until I actually observed one of the *Cryptamorpha*-larvæ, with a young *Brachypeplus*-larva firmly held in its jaws or mandibles, that I had proof of its predatory habits.

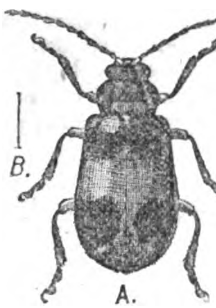


FIG. 1.
A The Pumpkin Beetle (*Aulacorhora hilaris*, Boisd.) Much enlarged. *B* Nat. size.

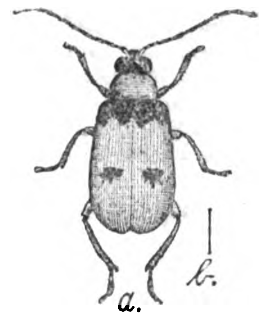


FIG. 2.
a The Two-spotted Monolepta (*Monolepta rosea*, Blk.) Much enlarged. *b* Nat. size.

In addition to the foregoing beetles, three plant-eating species were found, namely, the common northern plant-eating lady-bird (*Epilachna guttato-pustulata*, Fabr.), the Banded Pumpkin-Beetle (*Aulacophora hilaris*, Bois.), and the two spotted Monolepta (*Monolepta rosea*, Blk.). All these beetles injure the cane by eating the young leaves and buds, the last mentioned being especially abundant and destructive, and all of them are found on a large number of plants. The larva of the plant-eating lady-bird is a brightly-coloured and active creature, covered with long branched spines, but it seldom occurs on sugar-cane in sufficient numbers to do any extensive injury. The early stages of the other two species—the *Aulacophora* and *Monolepta*—are at present unknown, but, as I have stated elsewhere, it is extremely probable from what we know of the habits of some nearly related insects, belonging to the same family, that the larval and pupal stages of both these pests are passed underground at the roots of the plants upon which the mature insects are found, or possibly at the roots of some neighbouring plant of a different kind. Mr. Koebele found a larva at the roots of cane on the Tweed River, which he thought to be a *Diabrotica*, but this cannot be the case, as no true species of *Diabrotica* occur in Australia, as far as we know at present. It is more probable that it was the larva of *Aulacophora* or *Monolepta*, both nearly related insects.

Several kinds of beetle larvæ of the Lamellicorn tribe, including the so-called Christmas beetle (*Anoplognathus concolor*, Burm.), and several Cockchafers (*Lepidiota squamulata*, Waterh., *Lepidoderma albo-hirtum*, Waterh., *Heteronyx*, &c.), were found at the roots of the cane, but in no case during my visit did I find them very numerous or destructive.

Two other pests—a minute *Acarus* or mite, *Tarsonymus Bancrofti*, Mich., and a small species of scale-insect, were found on the Clarence River canes; but, like the beetle-grubs, not in sufficient numbers to do any material harm. The mite was first discovered by Dr. Joseph Bancroft* in Queensland, where it did great damage to cane, and it has since been recorded by Mr. A. D. Michael on sugar-cane from the Barbadoes.† I regret to say that I had no opportunity of inquiring into the habits of this mite, as

* Report of the Board appointed to inquire into the causes of Diseases affecting Live-stock and Plants, p. 12—Brisbane, 1877.

† Kew Bulletin, No. 40, April, 1890.

repeated and careful searchings, at the time of my visit, failed to reveal even a single specimen. Indeed, I have only once had an opportunity of examining the insect, and that was several months before these field observations were undertaken, when a few egg-sacs and young mites, were forwarded to the Department from the Lower Clarence. The *Coccus* is a very obscure species, and will require further investigation before its identity can be definitely established. It is found chiefly on the node, and between the leaf-sheathes, and its presence may readily be detected by the white powdery substance with which it is covered. It injures the cane, like the *Acarus*, by sucking the juices.

III.—Technical descriptions of the Insects observed.

LEPIDOPTERA.

NOCTUINA

Nonagria exitiosa, sp. n.

(*Pl. XXII, fig. E ♂.*)

HEAD and thorax dusky brown, abdomen rather paler; antennæ brownish grey; in the ♂ distinctly bipectinate; in the ♀ simple, finely pubescent; fore-wings light brownish-grey, rather glossy, dusted with small dusky brown scales; a distinct but small dark-brown dot on the disc considerably before the middle, and another similar dot immediately below this near the inner-margin; beyond the middle, a row of seven or eight dusky dots extending transversely across the wing, a hind marginal row of seven or eight distinct dusky dots; cilia long, dusky brownish grey; hind-wings dusky grey, slightly darker towards the hind margins; underside pale brownish grey, dusted with small dusky brown scales; the markings of the upper side not visible with the exception of the hind marginal row of dusky dots. Exp. ♂, 28–31 mm.; ♀ 30–36 mm.

Maclean, Palmer's Island, Chatsworth Island, Harwood Island, Clarence River, August to January; Ash Island, Hunter River (A. W. Scott), bred in July from larvæ found in native reeds; Tweed River, Mackay, Queensland.

This moth is so closely related to *Nonagria sacchari*, Woll., described as being exceedingly destructive to sugar-cane in Madeira, that I have had grave doubts as to the advisability of regarding it as a distinct species. However, as the original description of Mr. Wollaston,* and a more recent description and figure published by Mr. G. T. Baker † do not agree with the Australian specimens in certain points, I have thought it best to give our Clarence River pest a distinctive name, rather than to assume that it is identical with the Madeiran moth, notwithstanding the fact that insects affecting sugar-cane, or, indeed, any other pests injurious to cultivated crops, are very easily transmitted from one country to another. In my opinion it is better to run the risk of renaming a particular insect about which we have some definite information, than to mislead fellow-workers by assuming its identity with a species from a widely-removed locality upon insufficient grounds, and thereby deceive those who devote themselves to the study of animal distribution. *Nonagria sacchari* appears, from the figure and descriptions alluded to above, to be an insect of greater average size than our native specimens, and to have the markings less pronounced. It also appears to have the hind marginal marking composed of dots so closely associated as to form a more or less definite line, whereas our specimens

* Ann. Mag. Nat. Hist., (3rd series), I, p. 117 (1858).
† Trans. Ent. Soc., London, p. 209, pl. xii, fig. 4 (1891).

have but seven or eight clearly separate dots. The hind-wings also, would seem to be much lighter. Under these circumstances I propose to treat our insect as a distinct species, and to call it *Nonagria exitiosa.*

The larva of *N. exitiosa* (Pl. XXII, fig. G.), measures about 35 mm. when full grown, is proportionately bulky, and has the usual sixteen legs, and nine pairs of stigmata or breathing orifices; ventral aspect pale pinkish vinaceous, tinged with purple above, rather lighter towards the lateral line, which is very indistinct; the sides below the lateral line and the ventral aspect yellowish white: head corneous, dark chestnut brown; median line strongly impressed; the first thoracic segment with a corneous brownish yellow plate above, yellowish white at the sides; each segment with four dorsal and two lateral minute dark brown hair-spots, the dorsal spots disposed in pairs, two before and two behind the middle of the segment, the lateral spots just above and below the stigmata; a similar row of subventral hair-spots; terminal segment brownish yellow; stigmata conspicuous. The pupa (pl. XXII., fig F.), or chrysalis, is brownish red in colour and rather long. It is found in the burrow made by the larva.

HYMENOPTERA.

FAMILY ICHNEUMONIDÆ.

Apanteles nonagriæ, sp. n.

(*Plate XXII, fig. H*).

♂ ♀. Pitchy black, shining; head broad, rounded at the sides behind the eyes, finely and sparingly punctured; ocelli distinct; palpi pale testaceous; antennæ moderately long, piceous, composed of eighteen joints; basal joint reddish testaceous; mesothorax and scutellum shining, moderately strongly and sparingly punctured; metathorax opaque, moderately rugose; wings hyaline, slightly dusky; costa and stigma reddish testaceous; veins reddish testaceous; radial vein arising rather beyond the middle of the stigma, strongly incurved posteriorly; abdomen proportionately broad, the first segment about one-third the length of the others taken together, rugose-punctate, transversely impressed in the middle, the remaining segments shining, finely punctured; ovipositor not exserted; legs pale yellowish testaceous; knees, claw-joints, and posterior coxæ dusky. Length, 2½ mm.

A parasite upon the larva of the sugar-cane borer *Nonagria exitiosa*, within which it deposits its eggs. The cocoons are generally attached to the dead remains of the larva within the burrow.

The species appears to be closely related to *Apanteles aletiæ*, Riley,* a parasite of the destructive cotton-worm (*Aletia zelina*, Say.) of America, but it appears to be a larger and more elongate insect, and has the mesothorax more narrowed in front. It also differs in coloration and sculpture, as will readily be seen upon comparing the descriptions, but in all essential points of structure (*i.e.*, venation) the two species agree. Bred in July, August, and December, from larvæ obtained from the Richmond and Clarence River districts.

FAMILY CHALCIDIDÆ.

Euplectus Howardi, sp. n.

(*Plate XXII, fig. I.*)

♂. Black, somewhat shining; head comparatively broad, with a few fine punctures, rather deeply emarginate in front; ocelli distinct; antennæ rather

* Report on the Cotton-worm and the Boll-worm.—Fourth Report of the United States Entomological Commission, pp. 104 and 108. Washington, 1885.

robust, with seven distinct joints; rather strongly pubescent, pale testaceous; the scape moderately long and slender, the second joint as long as the scape (two very minute ring-joints only visible on dissection); joints three, four, five, and six, gradually decreasing in length and increasing in breadth; terminal joint ovate, black; pronotum exceedingly finely regulose-punctate; meso-scutum very finely regulose-punctate, with a fairly strong median line; meso-scutellum finely regulose; the meta-thorax strongly rugose, with a strongly impressed median carina; wings hyaline, marginal and sub-marginal veins pale fuscous, finely pubescent, the cilia long; abdomen rather robust, shining, broadest at about the middle; legs pale yellowish testaceous; the intermediate tibiæ with a small apical spine; the hind tibiæ with the spine comparatively inconspicuous; tarsi five-jointed. Length, $1\frac{1}{3}$ mm.

♀. Slightly larger than the male, antennæ with the funiculus and club dusky black.

A parasite on the chrysalis of the sugar-cane borer, *Nonagria exitiosa.*

It is with very considerable hesitation that I venture to describe this minute Chalcid, as I have found it almost impossible, with the scanty literature at my disposal, to fix the generic position with any degree of certainty. Unfortunately, many systematic workers are apt to take the existence of ample libraries and collections for granted, and are thereby led to overlook the needs of isolated students when describing insects belonging to obscure and little known groups. In locating this minute parasite, for example, I have found the chief difficulty to consist in the absence (in the various descriptive papers at my disposal) of a clear statement of the sectional characters of the genera. It is to be hoped that some entomologist, with the necessary opportunities and knowledge, will give us a general account of the structure of the parasitic hymenoptera before very long.

In the case of the species here called *Euplectus Howardi*, I trust that the accompanying figure will assist in its identification. Its tarsi are clearly five-jointed, and the antennæ, when viewed with an ordinary hand lens, appear to be seven-jointed. But when the antennæ are mounted in a saturated solution of carbolic acid, and viewed under a quarter-inch objective, two minute ring-joints are visible, and the club is seen to be composed of three intimately-connected divisions. These divisions, or joints, frequently break away from one another in the process of mounting for microscopic examination, but I have not ventured to count them as distinct joints in the above description, as I find the same structure, both as regards ring-joints and club, in several European species, which are said to have eight-jointed antennæ.

The species is dedicated to Mr. L. O. Howard, Assistant United States Entomologist, who has added much to our knowledge of the family to which it belongs.

Coleoptera.

Family CUCUJIDÆ.

Cryptamorpha Desjardinsii, Guérin.

(*Plate XXII, fig. C.*)

Dendrophaqus suturalis, White, Voy. Erebus and Terror, Ent. p. 18 (1846).
Cryptamorpha musæ, Wollaston, Ins. Mader, p. 157, pl. 4, fig. 1.

This cosmopolitan beetle was found in great numbers between the sheathes of the cane-leaves, frequently associated with the perfect insects and larvæ of *Brachypeplus binotatus*, Murr. It has been recorded from both the new

and the old world, and appears to be particularly common on the pine-apple, sugar-cane, and banana. I observed vast numbers of the adult beetle on the latter plant at Ambrym Island, New Hebrides, in July last year, and it has been observed on the same plant at Madeira by Mr. Wollaston, and at Lord Howe Island by Mr. Masters.

The following is a brief description of the larva, which does not appear to have been previously figured or recorded. It was observed to feed upon the young larvæ of *Brachypeplus binotatus*, Murr., and upon several species of Acari, or mites, belonging to the genus *Tyroglyphus*.

Larva of *C. Desjardinsii* (*Plate XXII, fig. D*): Elongate, narrow, rather flat, dull reddish testaceous, somewhat opaque. Head broadly transverse, rounded, and slightly projecting in front, rather strongly rounded behind the ocelli; a sharply impressed longitudinal line on each side of the middle. The sides provided with a few strong outstanding setæ. Labrum slightly rounded in front; ocelli five in number, placed just behind the base of the antennæ. Antennæ moderately long, four-jointed, clothed with strong outstanding setæ; the basal joint broad and very short, the second joint more than twice as long as the first the third joint about twice as long as the first and second together, the fourth joint narrower than the preceding ones, about as long as the third. Thoracic segments slightly broader than the head, with a distinct median line, setigerous at the sides; the first a little narrowed behind, the anterior margin very slightly rounded, the hind-margin more strongly rounded; the second and third segments decidedly narrowed in front, the hinder angles slightly produced. Abdominal segments broadly transverse, the sides rounded and armed with three or four long and numerous short, outstanding bristles, of these the hindermost is much the longest; the anal appendages long, gradually narrowing from the base, two-jointed, a conspicuous seta arising near the base; anal segment retractile, long, prominent, slightly narrowed posteriorly, truncate at the extremity. Nine pairs of normal stigmata. Legs rather long and narrow, finely setigerous, the claws simple. Length 6–7 mm.

Family NITIDULIDÆ.

Brachypeplus binotatus, Murray.

(*Plate XXII, fig. A.*)

Brachypeplus binotatus, Murray, Trans. Linn. Soc., London, Vol. XXIV, p. 290 (1864).

A very abundant species which is widely distributed in Australia. In its early or larval stage it was observed only on decaying portions of the cane, upon which, and the accompanying fungi, it undoubtedly fed. The following is a brief description of the larva:—

Larva of *Brachypeplus binotatus* (*Plate XXII, Fig. B*): Elongate, pale reddish testaceous, moderately convex, somewhat narrowed both in front and behind. Head rather small, broadly transverse, rounded at the sides, marked with irregular longitudinal corrugations, the interstices between the corrugations finely granulated, lateral margins finely denticulated. Maxillary palpi four-jointed; labial palpi two-jointed. A single large and prominent ocellus on each side. Antennæ four-jointed, short, the first joint very short, broad; the second rather narrower; the third about as long as the preceding joints together;

the fourth shorter than the third, very narrow, with a few fine hairs at the extremity. Thoracic and abdominal segments with longitudinal corrugations like those on the head, with a few fine setæ on each side; the first or prothoracic segment longer than the succeeding ones, slightly narrowed in front; all the segments with a short, robust, fleshy, lateral protuberance on each side; that on the prothorax conspicuous, placed near the hinder angle, those of the second and third thoracic segments very slightly developed; the others gradually increasing in size. Length, 5 mm.

IV.—Insects affecting Sugar-cane not yet observed in Australia.

The following insects have been found attacking cane in various localities outside Australia, and should, therefore, have an interest for us, as any one of them may yet be discovered in this country. The list is not intended to be complete, but merely an enumeration of those species which are most likely to occur here.

1. Shot-hole or Pin-borer (*Xyleborus perforans-X. pubescens*).—Destructive to crops in Barbadoes, Trinidad, and St Vincent. By some observers thought to follow the attacks of the sugar-cane moth (*Diatræa saccharalis*, Fabr.), and the boring weevil (*Sphenophorus sacchari*, Guild.). The *Xyleborus* is known to breed in mahogany, cocoa trees, Jatropha, and in the wood and corks of casks. The insect has recently been discussed at great length by Miss Ormerod, Mr. W. F. H. Blandford (*Kew Bulletin*, Nos. 67–68, pp. 154-178), and others. Mr. H. Caracciolo, of Port-au-Spain, as quoted by Mr. Blandford, has "ascertained that the alarming increase of the insects (*Xyleborus*) is coincident with the recent and general change in the method of disposing of the crushed cane—magass or bagasse." "Formerly," he writes, "it was the custom of planters owing sugar-mills to burn this refuse, whereas recently they have begun to use it as manure. The scattering of quantities of this dead vegetable matter through the fields must afford a most appropriate '*nidus*' for the beetles, which, doubtless, oviposit upon it very extensively. Their very numerous offspring developing at the time when the 'bagasse' has become too decomposed for further oviposition, will naturally take to such canes as are weakened by the attacks of the other insects mentioned (*Diatræa* and *Sphenophorus*), or even to healthy canes. The resumption of the old practice of burning this refuse will undoubtedly cause a decrease in the numbers of the insects."

Mr. Blandford says the *Xyleborus perforans* probably occurs in Australia, but he gives no evidence in support of this assertion.

2. The Weevil Borer (*Sphenophorus obscurus*, Boisd.).—Very destructive to sugar-cane in the Sandwich Islands, Fiji, and New Ireland; also found in the stems of banana trees. Bores much in the same way as our sugar-cane moth borer (*Nonagria exitiosa*, Oll.).

3. West Indian Weevil Borer (*Sphenophora sacchari*, Guilding).—A beetle which closely resembles the previous species. Has been observed boring in cane at St. Vincent, Barbadoes, and British Guiana.

4. Sugar-cane Root Beetle (*Ligyrus rugiceps*, Le Conte).—Found underground eating the roots and stalks of the cane in the United States; also known to damage maize and various grasses.

5. Common Sugar-cane Moth Borer (*Diatræa*, or *Chilo*, *saccharalis*, Fabr.)—This moth, or rather its caterpillar, has often been stated to commit injury in the Queensland cane-fields; but I am inclined to think that in most, if not in all cases, the moth here called *Nonagria exitiosa* is the actual culprit. There is no reason why *Diatræa* should not occur in Australia, and,

as I have already indicated in this report, there is great probability that it really does exist. At the same time I have never seen the insect, and I have failed to find it in any of our local museums and collections. Mr. E. C. Cotes (Insect Life, vol. IV, p. 397, 1892) records the fact that this species attacks sorghum and maize at Calcutta, and Mr. Howard has observed the pest in the latter crop in the United States.

6. Javanese Borer Moth (*Chilo infuscatellus*, Snellen).—A pest described from Jarva with habits like those of the foregoing species; also recorded with some doubt, from Calcutta.

Several other moths, and a few small mites, including members of the genus *Damæus* and *Notaspis*, are recorded as injurious to cane in Jarva, the West Indies, &c., but we have no evidence of their occurrence in Australia.

V.—Remedies and Means of Prevention.

The subject of remedies and means of prevention is doubtless a most important part of an investigation such as the present. At the same time, it is certainly the most difficult portion of the task, as will be evident when we consider the conditions under which sugar-cane is grown in this country. Whenever a particular crop that does not require any large amount of labour for its proper cultivation, is grown over large areas, it is always a matter of great difficulty to devise satisfactory means of remedying or preventing the attacks of insect pests, and this is eminently the case in the case of the sugar-cane crop. It is obviously quite impossible for the cane-grower to give his canes the constant attention and watchful care which the gardener bestows on his flowers and vegetables, and the vigneron on his vines, from the simple fact, if for no other reason, that very few hands are employed on the cane-fields, except at the time of trashing and cutting. It therefore follows that any means suggested for checking or preventing the attacks of insects must not involve the employment of any large amount of labour, or it will be disregarded on the ground of expense. As a general rule, it may be asserted that in all cases of insect attack, no matter what the particular insect causing the damage may be, a speedy burning of the tops after the removal of the crop, and the destruction of all trashings, rotting canes, and other refuse is most necessary. The neglect of this measure in most cases of attack by insects means that a large number of the enemy find suitable shelter during the winter, and are ready to renew their depredations with the return of spring. This is notably the case with those insects which live on the leaves and stalks of the cane. In the case of attack by the larvæ of Lamellicorns, cockchafers, wire-worms, &c., which live at the roots of the cane, other means must be adopted, and it is in dealing with cases such as these that the system of allowing the land to lie idle, commonly called "fallowing," has great advantages. If the land is allowed to lie fallow the root-feeders are gradually starved, and their numbers reduced in a way that is not possible by any other means.

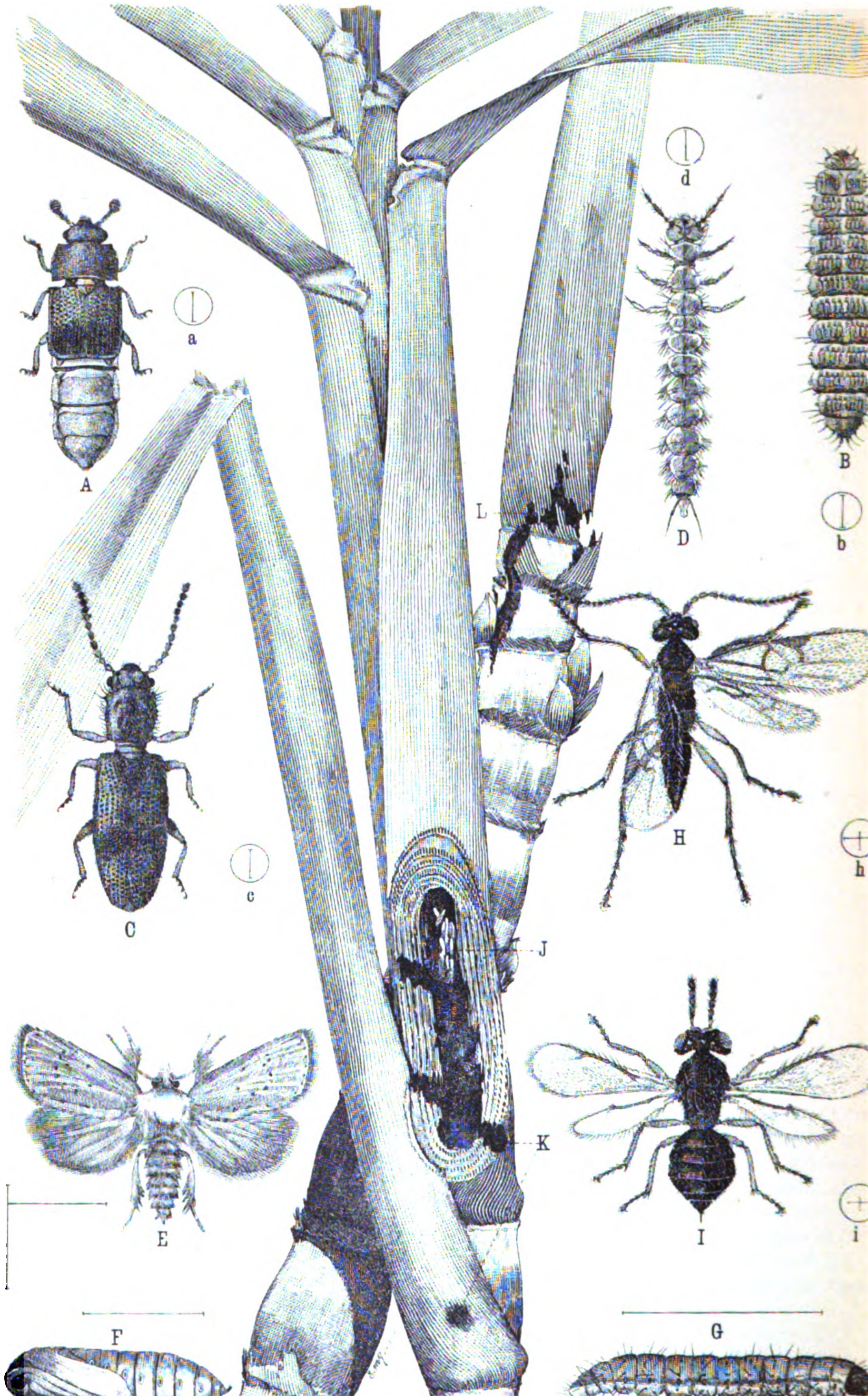
In dealing with the attacks of the sugar-cane moth borer (*Nonagria exitiosa*) which, as we have already pointed out, begins its attacks on the outskirts of the plantation, usually on the most easily accessible canes, it is highly desirable to cut out and destroy any infested canes, and these are easily detected. In young cane the plant droops, withers, and loses its fresh green colour, and older plants attacked by this pest, are easily recognised, as the burrows of the larva and its castings are easily noticed. There is, therefore, very little difficulty in checking this pest if it is dealt with before it has firmly established itself, and this it certainly does not appear

to have done on the Clarence River, as considerable time and trouble had to be expended to get together a couple of dozen specimens for examination. It has often been recommended in the West Indies that canes should be cut down close to the ground, so that no stumps are left in which the boring insects, whether moth or beetle grubs, could propagate, but this advice is hardly necessary under the present circumstances, as the canes on all the fields visited by me were cut as closely as possible, and this for the obvious reason that the grower is desirous of obtaining as heavy a crop (by weight) as possible. Professor J. H. Comstock suggests the use of lamp-traps as a means of attracting the American sugar-cane beetle, *Ligyrus rugiceps*, Le C., and doubtless the same plan would be found to give useful results in this country in the case of attack by the sugar-cane moth borer (*Diatræa exitiosa*), the *Anaplognathus*, or Christmas beetle, and other insects that can be attracted by means of light. For this purpose the patent lamp-traps which have been so much advertised during the past few years may be employed, or simple traps may be constructed by placing a bright light immediately over a tin or other receptacle with perpendicular sides, containing a small quantity of kerosene and water. If these traps are placed in conspicuous places in the cane-fields many destructive moths and beetles may be captured on still summer nights.

A certain measure of success appears to have attended the use of the manure known as Kainit (nitrate of potash) in Queensland against the attacks of root-feeding larvæ or grubs, such as wire-worms (*Elateridæ*), and the Lamellicorns, to which reference is made above, but it is to be regretted that we have no precise details regarding its usefulness; and it is, therefore, to be hoped that proper experiments will be made by growers in New South Wales who may have the opportunity. Professor Comstock states that lime placed about the roots of cane has proved a very successful protection against the *Ligyrus*, and it would certainly be worth while to try the effects of this simple remedy on fields attacked by our native root-feeding grubs. Soaking the ground with kerosene emulsion has also been suggested for their destruction, but apart from other considerations, the cost of the application, obviously forbids the employment of this remedy on any extensive scale.

In regard to the attacks of the pumpkin beetle, *Monolepta*, plant-eating lady-bird, and other beetles that destroy foliage and young shoots, it should be noted that the perfect beetles frequently visit flowering plants growing near the cane in large numbers; and when this is found to be the case, they may be killed very readily by spraying with Paris green and water in the proportion of 1 lb. of the poison to 180 gallons of water. Very frequently the adult *Monolepta* visits the tassels of maize in swarms, and it is then very desirable to spray the outer rows of the crop at all events, as vast numbers may be killed in this way.

As a precautionary measure against the attacks of sugar-cane mites, Dr. Bancroft recommends steeping the canes before planting for twenty-four hours in a solution of 1 lb. of carbolic acid to 100 gallons of water. He also suggests the use of a mixture of powdered sulphur in soap and water, the application to be made two or three times at intervals of a fortnight. It may be added in conclusion that all new stock, whether obtained from abroad or from a neighbouring cane-field, should be most carefully examined and disinfected before being planted. A little trouble expended in this way at the beginning may be the means of saving serious losses later on.



INSECTS ON SUGAR-CANE.

EXPLANATION OF PLATE XXII.

Fig. A.—Fungus-eating Beetle (*Brachypeplus binotatus*, Murray), greatly enlarged; *a.*, natural size.

" B.—Larva of same (enlarged); *b.*, natural size.

" C.—Predatory Beetle (*Cryptamorpha Desjardinsii*, Guerin), enlarged; *c.*, natural size.

" D.—Larva of same (enlarged); *d.*, natural size.

" E.—Sugar-cane Moth Borer (*Nonagria exitiosa*, Olliff), male; enlarged.

" F.—Pupa or Chrysalis of same (enlarged).

" G.—Larva or Caterpillar of same (enlarged).

" H.—Parasite on the Larva of the Moth-Borer (enlarged) (*Apanteles nonagriæ*, Olliff); *h.*, natural size.

" I.—Parasite on the Pupa of the Moth Borer (enlarged). (*Euplectus Howardi*, Olliff); *i.*, natural size.

" J.—Bunch of Cocoons of *Apanteles nonagriæ*, spun up on the dead skin of a Caterpillar of the Moth Borer.

" K.—Openings in the cane-stem, showing where the Moth Borer has emerged.

" L.—Track or burrow of Caterpillar of the Moth Borer.

N.B.—The natural sizes are indicated by hair-line.

The Hessian Fly.

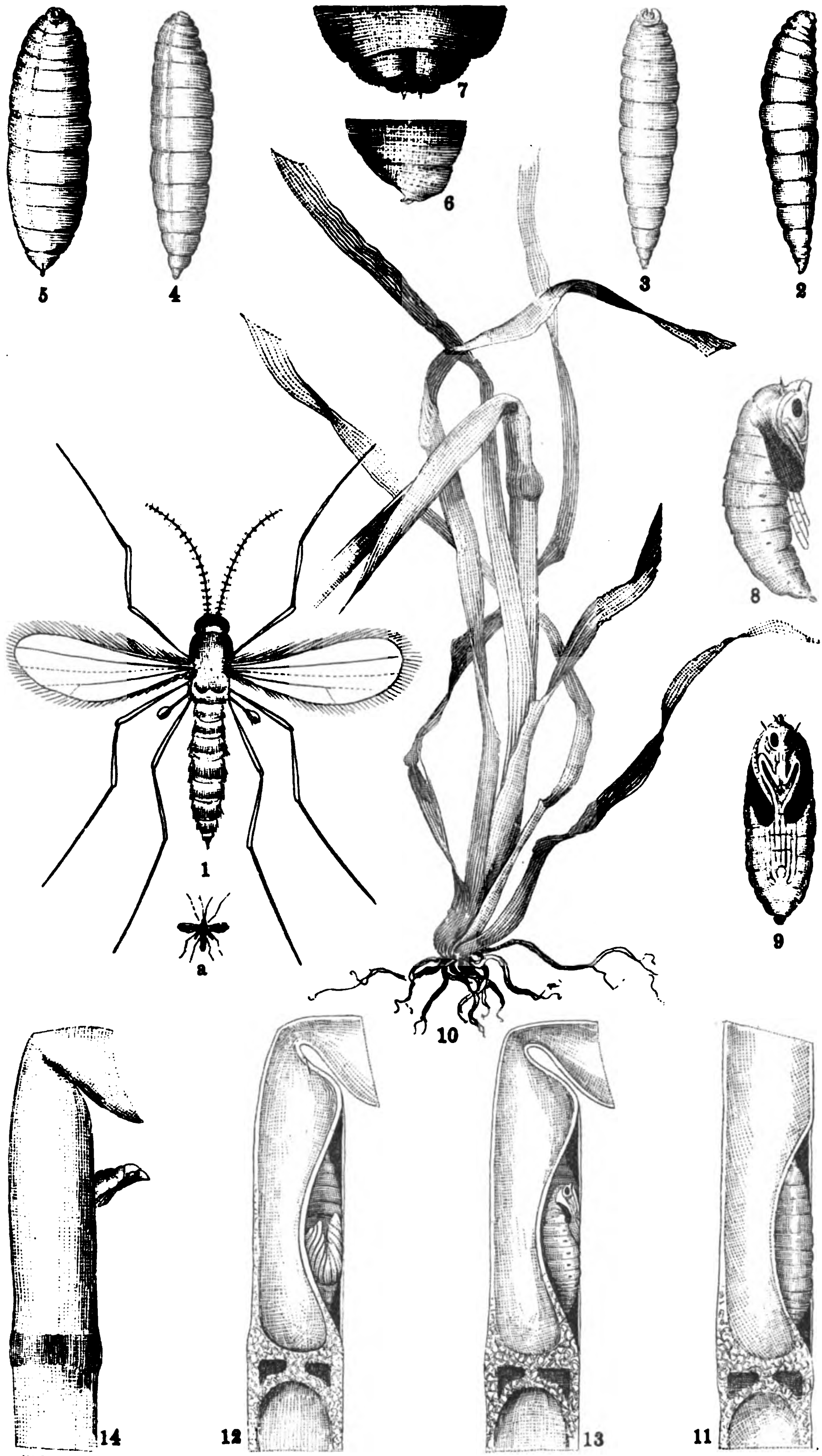
THE fact that the Hessian Fly (*Cecidomyia destructor*, Say.), has been reported for some years past to be causing much damage in New Zealand should be carefully noted by New South Wales farmers. Mr. A. Sidney Olliff, the Entomologist to the Department of Agriculture, in a report upon this destructive insect, says:—"I do not think it is at all likely that the Hessian fly could be imported in clean seed, but it has been clearly proved that the insect may readily be carried about in the form of puparia (often called by the unfortunate name of "flax-seed stage") in screenings of wheat, barley, and rye. It might also be imported in straw, whether used as packing material or not. The pest has been recognised for some years in New Zealand, but has not yet been observed in Australia."

The exercise of a little care on the part of farmers importing straw and screenings, and also by their making arrangements to ensure extreme cleanliness in any wheat they may desire to obtain from New Zealand, will, it is hoped, have the effect of securing the country from the advent of this dangerous pest. It is with this view that the Department of Agriculture desires to warn our farmers to be upon their guard.

The Entomologist, upon this matter being brought specially under notice, writes as follows:—

The Hessian fly in its adult stage is a minute dusky-brown, two-winged fly, belonging to the family *Cecidomyidæ*, or gall-gnats. The eggs appear to be laid just above a joint or knot in the stem of the particular cereal that they may attack, and upon hatching, the young grub or larva penetrates into the interior of the stem of the plant, and feeds upon its juices. The larvæ may also attack the plants above any other joint, or even attack the plant close to the root. If the plant is attacked above ground the point at which the larva entered is most usually indicated by the stem bending downwards above the point where the larva entered. Miss E. A. Ormerod says: "It does not usually break, but unless the straw is very firm it bends at the infested spot, and thus damage is caused to the fallen head. . . The injury is caused by the fly-maggots lying at the same spot sucking the juices from the stem, which is thus weakened, and presently, although both the stem and the ear above are (in any important amount of attack) more or less stunted, yet the weakened piece of stem cannot bear their weight, and it bends sharply down at the injured part. Sometimes a gall or swelling of the stem occurs just above where the maggot fed, but in the specimens I examined this was rarely noticeable."

The larva emerges from the egg within a few days after the latter is laid. It is a minute, soft, cylindrical creature, tapering towards each extremity, composed of twelve segments besides the head, and provided, in its adult stage, with a curious horny appendage on the ventral surface, commonly called the "breast-bone" or "anchor process." The larval stage is supposed



THE HESSIAN FLY.

to last about twenty-eight days, when the pupal condition is assumed at the the place attached. The pupa is enclosed within a puparium, which is elongate and rather flat. This stage is commonly called the "flax-seed stage," from a fancied resemblance to the seed of that plant. The entire transformations are said to occupy about sixty-five days.

Mr. Frederick Enock has lately made some interesting and instructive observations on the development of this pest (Trans. Ent. Soc., Lond., 1891, pp. 329-366). He says: "The female fly, as a rule, lays her eggs with the head-end pointing downwards towards the main stem. When the tiny larva emerges it is started from its infancy in the right direction on its journey downwards, and guided by the longitudinal striæ of the leaves, it reaches the stem, round which the leaf-sheath is closely wrapped, but not too close to prevent the larva forcing its way."

Mr. Enock, whose observations are evidently the outcome of most careful study, makes some very important remarks regarding the characteristic "breast-bone" or "anchor-process." "Anyone," he says, "who will take the trouble to carefully examine under the microscope the true larva (by this I mean the larva in its first or feeding stage), will at once see that it does not possess any anchor-process at all, and it is not until the *final* larval stage, when the larva is securely sealed up within the puparium or coarctate larva, or second larva stage, that the anchor-process is developed and utilised in the most wonderful manner." Mr. Enock goes on to describe his observations as to the use of this breast-bone or anchor-process in great detail, but we need not enter into particulars here. It is, however, important to note that many of our native *Cecidomyiæ* certainly possess this breast-bone in the active larval stage even when very young; for instance, the *Diplosis* larvæ that are so commonly found eating the spores of various rusts (*Puccinea*) on wheat and other plants. The presence of this breast-bone is so important as a means of identifying the larva, and so characteristic of the group, that these details cannot be regarded as superfluous. As this note is merely intended as a warning to farmers and others, it will not be necessary to go into details regarding remedies and means of prevention, as this would require a lengthy article; but it may be said, in conclusion, that should the Hessian fly unhappily make its appearance in this country, we shall have to do our best to introduce and propagate the parasites of the pest of which quite a number are known in Europe and America.

EXPLANATION OF PLATE XXIII.

Fig. 1.—The Hessian Fly (*Cecidomyia destructor*, Say) much enlarged; a, natural size. (After Packard.)

Figs. 2 and 3.—Lateral and ventral view of larva, × 8 diam. (After Enock.)

Figs. 4 and 5.—Lateral and ventral view of puparium, × 8 diam. (After Enock.)

Figs. 6 and 7.—Lateral and ventral view of 1st, 2nd, and 3rd segments of third stage of larva, × 36 diam. (After Enock.)

Figs. 8 and 9.—Lateral and ventral view of pupa, × 8 diam. (After Enock.)

Fig. 10.—Wheat-stalk attacked by Hessian Fly, showing characteristic bending.

Fig. 11.—Diagramatic section through centre of barley-stalk, showing a feeding larva *in situ*. (After Enock.)

Fig. 12.—Section through centre of bent barley-stalk; 3rd stage larva turning round. (After Enock.)

Fig. 13.—Section through centre of bent barley-stalk; pupa within puparium.

Fig. 14.—Bent barley-stalk; pupa protruding, previous to the fly emerging. (After Enock.)

Temperatures for Fruit Export.

WE give herewith the figures extracted from the engineer's log of one of the P. & O. Company's steamers, which has been most successful in taking cargoes of fruit to the English market. These figures provide interesting reading in view of the fact that the whole cargo of 10,600 cases of fruit was discharged in excellent condition. The temperature was taken by means of registering thermometers in five different parts of the hold every four hours, and also noted in a special room above the main hold which had been fitted up for fruit carriage. It will be noted that the temperature has not been so low as most people imagine it is necessary to keep it, having varied between 46 degrees and 60 degrees. The engineer who is in charge of the fruit is convinced that the essential for getting fruit to England in good condition is to have the air as dry as possible, and kept at a very even temperature, not necessarily below 50 degrees. He has, therefore, taken special precautions to prevent the cold air striking the fruit cases when it enters the hold, as any moisture in the air is at once condensed by the intense cold of the incoming blast of air, and takes the form of snow on the cases. By taking special precautions the blast of cold air is made to strike against screens on which the moisture is condensed and led away when it thaws into special channels which take it outside the hold. The main difficulty, in the opinion of engineers who have had most experience with this trade, is that the oxygen of the air is not renewed often enough by the Haslam process, as the same air is forced into the hold, and drawn back again into the cylinders with very little addition of atmospheric oxygen. In the cool chambers in which the Department's experiments have been conducted on shore, provision has been made for drawing off the air by means of a ventilating fan, so that fresh-air may be introduced as often as is deemed desirable. Probably some modification of this process will be adapted to the holds of the large carrying steamships, in order to get rid of the carbonic acid gas which is exhaled by the fruit, and to introduce fresh oxygen or ozone, which when dry is less conducive to fungus growth.

LOG for Refrigerating Machine (Haslam's Patent), from Adelaide to Sydney and from Sydney to London.

Date.	Water Temperature.	Temperatures. In pipe to composition cylinders.	In pipe from composition cylinders.	In pipe from tower.	In pipe to expansion cylinders.	Snow box below zero.	Hold. Port Aft. Top.	Star. Mid. Top.	Port Fore. Hatch.	Port Baft. Fore.	Star. Bottom Fore.	Mean.	Cargo fruit room.	Of atmosphere.	Remarks. Arrivals, Departures, &c.
1891.															
17 March...	69	65	250	75	54	50	...	...	...	...	...	...	...	62	Arrived and left Adelaide.
18 „ ...	64	61	250	70	51	55	...	...	...	...	...	...	...	62	
19 „ ...	69	64	254	75	53	51	...	...	...	...	...	...	...	69	Arrived Melbourne.
20 „ ...	68	63	252	73	54	50	...	...	...	...	...	...	...	69	
21 „ ...	68	62	252	73	52	53	...	...	...	...	...	...	...	62	Left Melbourne.
22 „ ...	67	62	253	72	52	54	...	...	...	...	...	...	...	65	
23 „ ...	74	68	264	80	58	45	...	...	...	...	...	...	...	78	Arrived Sydney.
24 „ ...	74	68	264	80	58	45	...	...	...	...	...	...	...	78	
1 April ...	74	66	266	77	57	45	...	...	...	...	...	...	...	75	Received ship's provisions.
2 „ ...	70	66	266	77	57	45	...	...	...	...	...	...	...	75	do do
3 „ ...	70	68	272	78	63	45	...	...	...	...	...	...	...	75	do do
4 „ ...	71	68	270	78	63	45	...	...	...	...	...	...	...	68	Received milk. Left Sydney.
5 „ ...	71	68	270	78	63	45	...	...	...	...	...	...	...	67	
6 „ ...	71	68	270	78	63	45	...	...	...	...	...	...	...	65	Arrived Hobart. Received fruit Cargo.
7 „ ...	71	66	280	75	58	45	...	...	...	...	...	...	...	59	Left Hobart.
8 „ ...	68	58	280	77	58	48	55	59	56	56	59	57	52·3	61	Arrived Melbourne.
9 „ ...	60	64	280	69	61	48	52	59	56	58	57	56·4	52·7	61	
10 „ ...	62	60	280	69	61	48	53	59	57	58	57	56·8	51·7	61	
11 „ ...	62	65	282	72	62	48	53	60	58	59	57	57·4	52·6	76	Left Melbourne.
12 „ ...	65	65	288	74	62	50	53	60	58	60	56	57·4	52	64	
13 „ ...	62	67	290	72	62	50	54	60	59	60	54	57·4	51·7	64	Arrived Adelaide.
14 „ ...	68	64	280	72	62	50	56	59	60	60	53	57·6	50·6	64	
15 „ ...	66	65	280	72	64	50	58	58	59	60	52	57·4	51·7	64	Left Adelaide.
16 „ ...	64	65	285	73	64	50	58	58	59	59	52	57·2	49	63	
17 „ ...	64	65	286	73	65	50	57	57	58	59	51	56·4	47·7	70	
18 „ ...	65	68	288	75	65	46	55	56	58	58	51	55·6	46·8	65	Arrived and left Albany.
19 „ ...	68	67	288	76	67	46	54	55	58	57	51	55	46·5	68	
20 „ ...	69	71	288	77	67	46	53	54	56	56	50	53·8	47	70	
21 „ ...	73	74	281	80	67	45	50	53	55	56	50	52·8	46	78	
22 „ ...	78	74	281	85	67	45	51	53	54	55	50	52·6	47·3	78	
23 „ ...	81	74	280	87	68	40	53	53	54	56	50	53·2	50	82	

LOG for Refrigerating Machine (Haslam's Patent), from Adelaide to Sydney and from Sydney to London—*continued.*

Date.	Water Temperature.	Temperatures. In pipe to composition cylinders.	In pipe from composition cylinders.	In pipe from tower.	In pipe to expansion cylinders.	Snow bow below zero.	Hold. Port. Aft. Top.	Star. Mid. Top.	Port. Fore. Hatch.	Port. Baft. Fore.	Star. Bottom. Fore.	Mean.	Cargo fruit room.	Of atmosphere.	Remarks. Arrivals, Departures, &c.
1891.															
24 April ...	82	77	280	87	69	35	54	53	53	57	51	53·6	50·3	83	
25 " ...	83	77	281	88	69	80	56	53	54	57	52	54·4	51·3	82	
26 " ...	84	81	282	90	74	30	58	54	53	54	53	54·4	52·6	86	
27 " ...	84	81	282	90	74	30	58	54	53	56	54	55	53·3	86	
28 " ...	87	82	283	92	76	25	59	54	53	56	55	55·4	54·7	86	Arrived at Colombo.
29 " ...	87	82	283	92	76	25	60	54	52	56	54	55·2	55·3	80	
30 " ...	86	84	235	93	78	25	60	54	51	56	54	55	54·6	91	Left Colombo.
1 May ...	86	83	236	93	79	25	60	53	51	55	53	54·4	53·3	86	
2 " ...	86	83	286	93	79	26	57	56	50	55	53	54·2	52·3	88	
3 " ...	84	81	290	91	77	26	57	56	60	55	54	54·4	55	87	
4 " ...	84	81	304	91	76	26	57	57	53	54	52	54·6	55.6	86	
5 " ...	84	80	302	91	76	28	58	57	55	54	52	55·4	54·3	86	
6 " ...	83	78	296	89	74	31	58	57	54	54	53	55·2	55·3	85	
7 " ...	86	82	290	83	75	30	58	57	53	53	52	54·6	55·6	87	Arrived at Aden.
8 " ...	85	80	300	91	75	30	59	57	53	54	52	55·2	54·	87	Left Aden.
9 " ..	86	82	300	93	76	28	60	56	53	53	53	55·2	54·3	86	
10 " ...	79	76	286	86	71	32	58	56	53	54	53	54·6	55·	86	
11 " ...	74	72	288	81	69	35	57	56	53	54	52	54·4	54·6	77	Arrived and left Suez.
12 " ...	74	74	286	81	70	85	58	55	53	54	51	54·2	58·3	84	
13 " ...	68	68	280	74	65	42	55	54	52	54	50	53·	52·	78	Arrived and left Port Said.
14 " ...	63	64	274	72	60	48	56	54	51	52	49	52·4	56·	67	
15 " ...	65	66	242	73	62	48	55	53	52	51	48	51·8	52·	66	
16 " ...	63	63	232	72	60	48	55	52	52	50	47	51·2	50 6	66	Arrived and left Brindisi.
17 " ...	62	62	276	70	59	48	54	52	52	50	47	51·	50·6	60	Arrived and left Malta.
18 " ...	63	62	268	71	58	48	52	52	51	51	46	49·8	51·	64	
19 " ...	63	62	268	71	58	48	51	51	51	50	46	49·8	51·	67	
20 " ...	63	62	268	70	58	48	51	51	51	49	48	50·	51·	65	Arrived and left Gibraltar.
21 " ...	62	62	268	70	58	50	52	51	51	49	48	50·2	51·6	62	
22 " ...	58	58	234	65	54	51	52	51	50	49	48	50·	51·3	56	
23 " ...	53	52	246	61	49	55	51	51	50	50	48	50·	51·6	50	Arrived and left Plymouth.
24 " ...	53	50	242	60	45	56	52	52	52	51	50	50·	51·8	50	Arrived at London.
25 " ...	53	50	244	60	45	55	...	...	...	...	...	...	...	...	
26 " ...	53	50	245	60	45	55	...	...	...	...	...	...	...	...	Fruit discharged.

Cheese-making by Small Farmers.

The Canadian Cheddar System.

Notwithstanding the fact that the bulk of the cheese manufactured for export will be turned out by the co-operative factories, there is still a very natural desire on the part of farmers to make a small quantity, if only for home use. To meet this want the *Australian Farm and Home* published recently an exhaustive interview with Mr. David Wilson, of the Victorian Department of Agriculture, the gist of which we reproduce, together with woodcuts of some of the appliances, for the benefit of farmers similarly situated in New South Wales.

At the outset Mr. Wilson points out the difference between the Canadian and what is called the American or "acid" system. This latter consists in simply allowing the curd to remain in the warm whey (100 degrees), until it has reached the "acid" stage. The weak point of the acid system is that cheese made by it cannot be depended upon to stand a long voyage—say, for exportation to London—until the article is fully three months old,

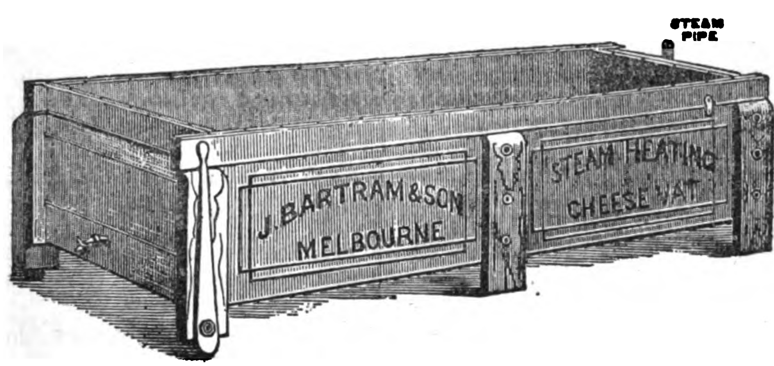


Fig. 1.—Milk-heating Vat.

owing to the certainty of the cheese "heaving" if exported before that age. When to this three months the duration of the voyage is added, the cheese will be from four to five months old before it reaches London, when it is altogether too old and stale to meet the taste of the English consumer. Mr. Wilson expressed the opinion that on this account he did not think many tons of such cheese could be exported at a profit.

The New System.

The development of the cheese trade both in Canada and New Zealand has proved the necessity for introducing the system that has so successfully enabled those countries to export large quantities of cheese annually, known as the Canadian system of cheddar cheese-making.

This being the system to be described, there is the absolutely necessary preface that cleanliness must be observed in milking the cows, and removing the milk to the cheese room or dairy. Care should be taken, if quality is expected, that none but good, sound, rich milk from healthy cows be used. Strain the milk right off into the receiver "vat" (fig. 1), and heat up to 86 degrees Fahr. Where there is no engine or boiler on the farm, the necessary heat can be obtained by having some boiling water ready in pots, two or three buckets of hot water being sufficient for the purpose. The quantity of hot water will depend upon the amount of milk to be heated, but practice will soon put a person right on this matter.

When to add the Rennet.

The stage at which to add the rennet having arrived when the milk is at 86 degrees, put about 5 ounces of the milk—a graduated measuring glass (fig. 2), can be bought for 2s.—into a teacup. To the 5 ounces of milk add one tea-spoonful of Barnekow's or Hansen's artificial rennet. Stir milk and rennet together for five seconds, and then watch for it to thicken. Should it thicken in from fourteen to seventeen seconds, the milk in the "vat" is ripe enough for "setting,"—that is, to receive the rennet. Add at once annatto at the rate of 1 ounce, and about five minutes afterwards, during which the milk must be well stirred, rennet at the rate of 2 ounces for every 50 gallons of milk. These are the correct proportions. Increase or decrease the quantity according to the number of gallons of milk in the "vat." Cheese intended for export to London should not have more than half an ounce of annatto per 50 gallons of milk, as the English consumer prefers a straw or lightly-coloured article. After adding the rennet keep the milk stirring for another five minutes, so as to mix thoroughly, and then let it settle. Keep closely on the watch, however, until it thickens, which should be in about twelve minutes after the rennet is added.

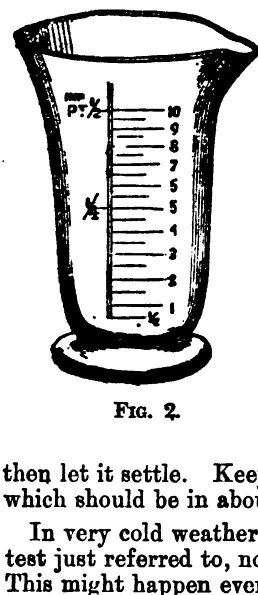


FIG. 2.

In very cold weather there is a possibility of the milk used in the 5-ounce test just referred to, not thickening in the number of seconds mentioned. This might happen even when the milk is at 86 degrees, owing to the lowness of the surrounding temperature. When this happens the temperature of the milk in the "vat" must be continued for a little while longer at 86 degrees, or even increased a little, but on no account going over 90 degrees. By waiting for a few minutes, keeping the "vat" a little over 86 degrees, the milk will ripen, despite the cold weather, when the fourteen to seventeen seconds' test in the tea cup will come out all right. The rennet must not be added until proof of the proper ripeness of the milk has been determined by the tea-cup test. There is a very simple plan for telling the very moment the milk in the cup has thickened, and beginners ought to make use of it. When the 5 ounces of milk are put in the cup, before adding to the rennet, put a small chip, say, half an inch of a wooden match, or small piece of cork, into the milk, and then stir rapidly when adding the rennet. The little chip will whirl round with the milk, but the very second it thickens

the chip will suddenly stop. By keeping a close eye on your watch, the exact number of seconds from the adding of the rennet to the stopping of the chip is easily counted.

Cutting the Curd.

Having thickened the milk, the next things to be considered are when to cut the curd and how it is done. As already stated, the milk takes twelve minutes to thicken from the time the rennet is added. The rule for telling when the curd is ready for cutting is as follows:—Watch and ascertain the exact number of minutes the milk takes to thicken. In double this time and a half from the thickening of the milk, the curd will be ready to "cut." To make this perfectly clear, suppose the milk takes exactly twelve minutes to thicken, in thirty minutes (twice twelve and a half) after it has thickened "cutting" can be commenced. When everything goes right the cutting should commence from forty to forty-two minutes from the time of adding the rennet.

By way of illustration as to how the operation works out:—

Add rennet at 9 o'clock.
Stir milk until five minutes past 9.
Milk thickens (curds) at twelve minutes past 9.
Cut the curds thirty minutes afterwards, which will be eighteen minutes to 10.

The practice of dipping a finger in the curd will be altogether unnecessary if the above rule be followed.

The greatest care must be taken in cutting the curd so as to completely avoid breaking or bruising it in any way. The cutting must be cleanly done, leaving no bruised surface. The knives (fig. 3) must cut well. There should be no dragging, nor should there be any ragged surface on the curd when cut. First use the horizontal steel knife lengthwise, going from end to end of the "vat," then use the vertical knife also in the same direction. After this the vertical knife is run through the curd, across the "vat"—that is, from side to side. The curd, then, should be all in the size of ½-inch cubes. When the curd has been cut, more boiling water has to be used, in order to raise the temperature up to 100 degrees Fahr. Before surrounding the "vat" with hot water, it is always best to run your hand gently round the sides and bottom of the inside of the "vat," to remove any curd that might be sticking there. It will take about forty minutes to raise the temperature to 100 degrees, the curd meanwhile being kept slowly stirred with a rake having the teeth set wide apart, so as not to bruise the curd. As the curd gets firmer, stir faster until 100 degrees has been gradually reached in the forty minutes. When 100 degrees has been reached, draw the hot water away from the "vat" at

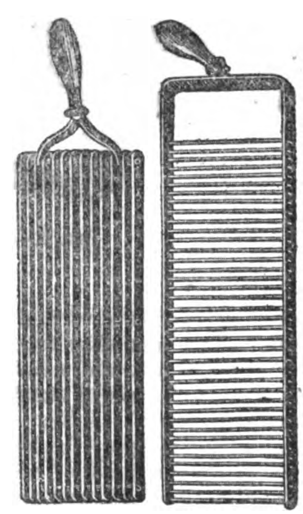


Fig. 3.

once and allow the curd to settle down for about an hour and a half, the vat meanwhile being covered, so as to maintain an even temperature. At the expiration of an hour and a half sufficient acidity ought to be produced in the curd to permit of the whey being drawn off.

Testing for "Acidity."

The hot-iron test is almost the only sure one for showing when the "acidity" is coming. Get a piece of ½-inch iron and make it nearly, but not quite, red hot. Take a handful of the curd, squeeze the whey out by compressing it gently, and apply the hot-iron to it. If when lifting the iron up from the curd it draws out fine threads about one-eighth of an inch long, it is time to draw the whey off and remove the curd to the cooler. If, however, the fine threads are not seen to be drawn up by the iron, the curd must remain a little longer in the whey, in order to reach the proper stage of "acidity."

In the "Cooler."

When the whey has run off remove the curd to the cooler (fig. 4). Here the curd has to remain for about ten minutes, so as to give it time to "mat." After "matting," it is cut into squares for convenient handling, and also to

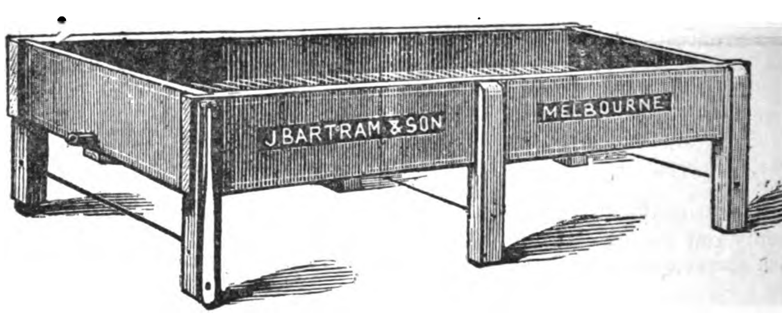


FIG. 4.—CURD COOLER AND STRAINER.

permit of further drainage of any whey. Still keep covered, and every quarter of an hour after turn the curd. This process is continued for about an hour to an hour and a half. It is important to keep the "cooler" covered with a sheet or piece of strong "duck" in order to keep the curd warm and develop "acidity." After being from an hour to an hour and a half in the "cooler," again apply the hot iron test for acidity, when, if the fine threads this time draw out fully ¾ of an inch long, it is time to put the curd through the curd cutter. If the fine threads do not come as described, turn the curd again, cover the cooler, and wait a little longer. Developing the proper acidity is one of the secrets of success. If everything goes all right, the curd should not require to be in the cooler for more than from an hour and a quarter to an hour and a half; but at the very outside not more than an hour and forty minutes.

The Curd Cutter.

The common curd mills will not do. These mills bruise, tear, and grind the curd down too fine, thereby allowing the richness to escape, which reduces the quality of the cheese. A curd cutter (fig. 5) must be obtained for the purpose, the new style of machine cutting the curd as clean as you

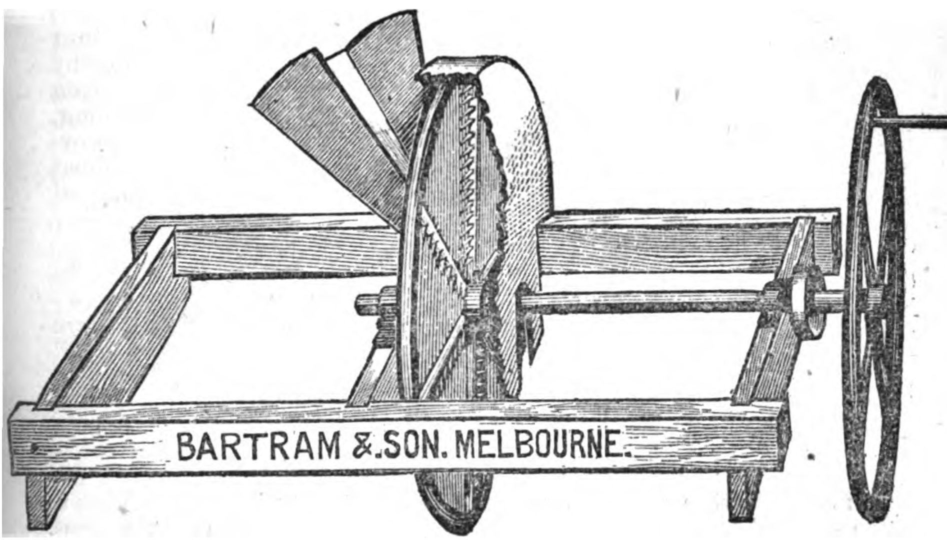


FIG. 5.—THE CURD CUTTER.

would cut chaff, instead of bruising it down as the curd mills do. The curd is only put through the "cutter" once, and it comes out in clean cut strips, each about 3 inches long by about ½ an inch in diameter.

Salting and Pressing.

After putting through the cutting machine, the curd must be kept stirred and turned over now and again to prevent "matting," which operation also circulates the air through it, and cools it down to about 72 degrees, when it is ready for salting. Allow at the rate of 1 lb. of salt for every 50 gallons of milk you had in the "vat." After mixing the salt through it give the curd another ten to fifteen minutes, to allow the salt to dissolve further before putting it into the "hoops" and pressing. Where large quantities of cheese are made, such as in factories and on large dairy farms, the "gang press" (fig. 6) should be used, but for small dairymen, making only one or two cheeses a day, the ordinary screw press (fig. 7 or a "double" one) will do, as it saves the outlay for a "gang." The hoops being made of galvanised iron, and in four pieces, are one of the greatest improvements in modern cheese-making plants, as they entirely dispense with all the bother that used to be attached to the proper adjusting of lids and trimming the edges of the cheese. Be careful not to press the curd hard for the first half-hour, or the

richness of the cheese will be lost. A sudden heavy pressure at first will also form a skin on the cheese, which will prevent a free escape of whey, resulting in a "streaky" or "mottled" cheese. Increase the pressure in

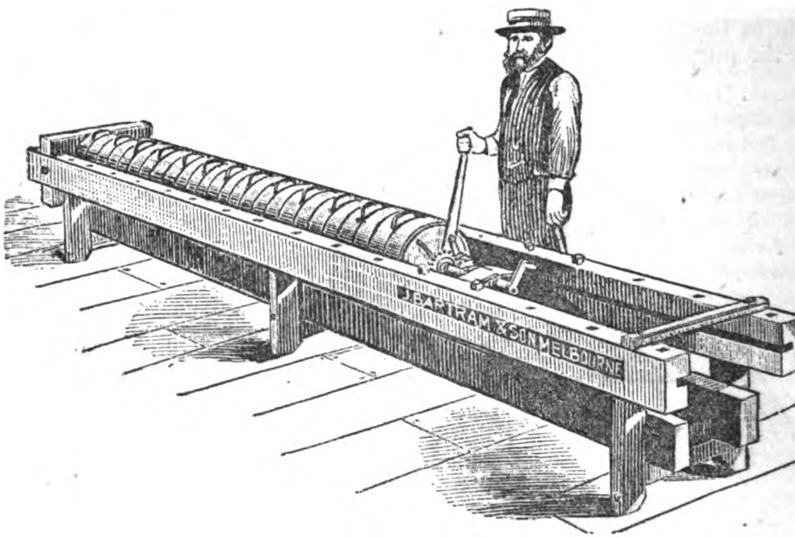


FIG. 6.—THE "GANG" CHEESE PRESS.

half an hour's time gradually. From fifteen to twenty hours, according to the size of the cheese, will be long enough for it to remain in the press. Remove from the "hoops" and transfer direct to the shelves of the curing-room.

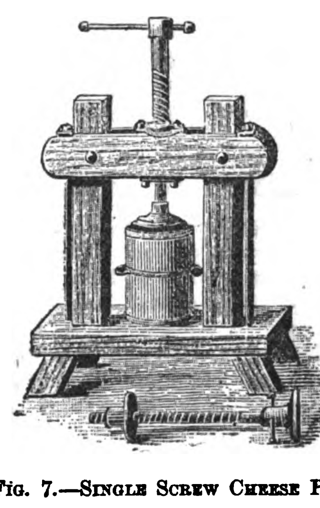


FIG. 7.—SINGLE SCREW CHEESE PRESS.

Mr. C. McKinnon, who was appointed last year as cheese expert to the Victorian Department, and is a very experienced maker of Cheddar cheese for the London market, was also interviewed. He supports Mr. Wilson in every

particular. He adds the following additional information regarding the treatment of cheese when turned out of the "hoops." The cheese should be turned once a day until it is six weeks old, when it is ready for export to London. When six weeks old the cheese kept for the Australian market need only be turned every second day until it is three months old, when it is fit for consumption. It is very important that a uniform temperature of 66 deg. Fah. be maintained in the curing-room. With regard to salt "Black Horse Brand" is that generally used by cheese-makers, and there is a seamless bandage which should be used by all makers shipping to the London market.

It is a good plan to test each bottle of rennet opened, as there is a good deal of variation in quality. If a teaspoonful of rennet does not thicken 5 oz. of milk in the cup in seventeen seconds, in favourable weather, then the rennet is weak in quality, and the proportion per 100 gallons (given elsewhere) of milk in the vat will have to be increased. Experience and close observation very soon enable even a beginner to determine the exact quantity of rennet to use should the quality vary a little in strength. The use of too much rennet must be guarded against. Too much rennet is another of the causes of "streaky" and of "bitter" cheese.

Poultry.

By SAM. GRAY,
Sub-Editor.

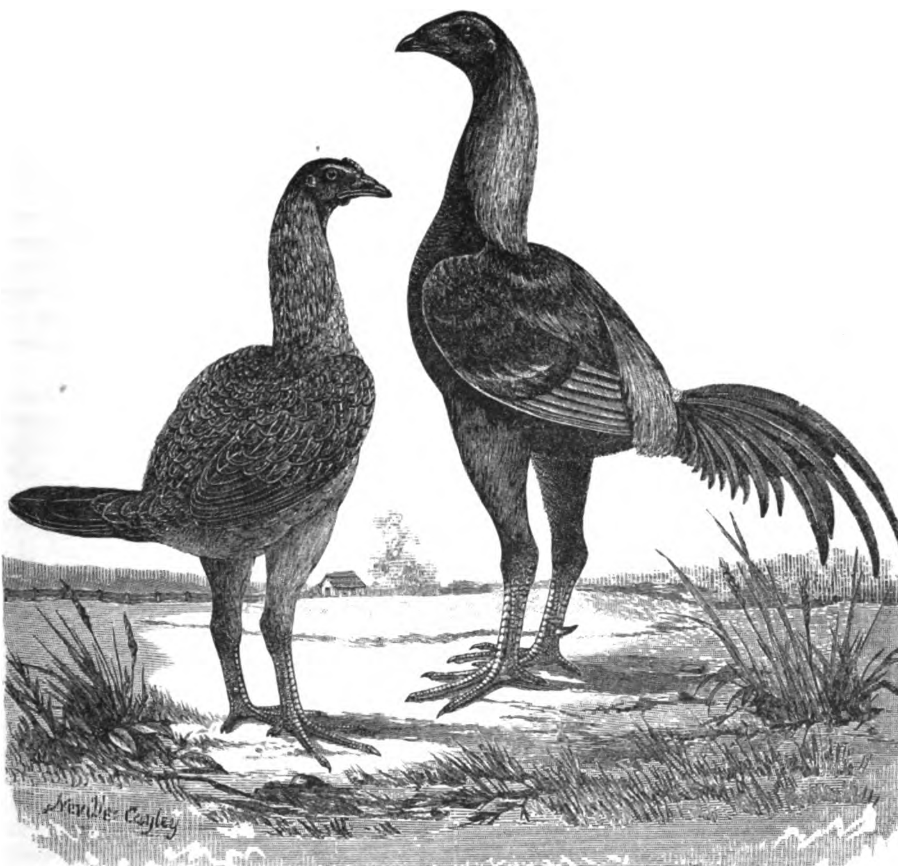
The Australian Game.

With a view to placing before readers of the *Gazette* the peculiarities, good qualities and failings of the many valuable breeds of fowls, it is intended to present a series of monthly illustrated articles, each month dealing with a different breed. These articles will not only contain all that can be gathered as to the origin of the breeds, but as far as possible, information from reliable sources as to their suitability to the varied climates and conditions of the Colony will be included, with a view to assisting farmers in selecting a breed or breeds which will give fair returns, thus saving them, as far as possible, from the expense and annoyance of testing a number of different breeds on their own account.

The preparation of such a series in England or America would necessitate a considerable amount of thought as to which breed should form the subject of the opening article. In Australia, however, the writer need have no hesitation on that account. The place of honor falls naturally to the only Australian breed which our fanciers have so far produced, and the handsome and useful bird known originally as the Colonial game, and more recently as the Australian game, will, therefore, form the subject of our first article.

The illustration of a male and female bird of this breed accompanying this article is an excellent representation of the high standard to which our breeders have attained. That it is perfection I must hesitate to affirm, as no true breeder is ever perfectly satisfied, and, moreover, I am well aware that steady work is still going on in the yards of some of our most noted breeders to reach the ideal bird, which is already pictured in their mind's eye. Meantime I have to record the acknowledgments of the Department to the proprietors of the *Australian Fanciers Chronicle* for unreservedly placing their block at my disposal. That the block is valuable will be fully appreciated when I state that it is the result of the careful deliberations of a committee of breeders who, under the auspices of the New South Wales Poultry Pigeon and Dog Society, met to fix a standard for the breed; and their views were most ably carried out by Mr. Neville Cayley, the well-known bird artist.

When it is considered that the origin of the breed dates from about 1870, it would appear somewhat remarkable that there should be any difference of opinion as to the breeds used in its production. The reason for this is probably contained in a remark by Mr. W. H. Webb, of Bathurst, in his article on the breed which appeared in the *Sydney Mail* of the 14th September, 1889. He states that "it is only within the last ten years that rapid improvements have taken place." It is on the one hand confidently stated that the Australian game is the result of a cross between the Aseel and the British game; while others assert that the Malay and the British game only



AUSTRALIAN GAME.

were used in forming the breed. It is a well-known fact that the earlier specimens did partake more of the Aseel type, in that they were comparatively short on the leg. But I cannot help thinking that at some time or other the Malay has had a good deal to say in the matter, as evidenced by the cruel eyebrow, the rich red colour of the feathering, and the strong tendency of the chicks to showing yellow in the leg. It is quite possible that when troops were sent from India to these colonies some Aseels may have found their way here in the train. But it must be remarked that Aseels are extremely shy breeders, and, moreover, are so terribly pugnacious that it is often impossible to place two hens in a pen with a male bird. There is another point also which may account for the shorter legs of the earlier specimens. No doubt the first British game birds introduced into the Colony were of the "old" or short-legged type of fighters.

That the breed originated in the Hawkesbury district is almost certain, that district having in the old days, as it is at present, been noted for game birds, so much so that one is almost led to the belief that cock-fighting has occasionally been indulged in by the inhabitants. Under all the circumstances, I cannot help inclining to the belief, and record it for want of more definite information, that a promiscuous cross took place some twenty years ago between British games and Malays in one or more of the old breeders' yards. The resulting chicks would naturally take the eye of an experienced fancier, as most Hawkesbury men are, and some of them were led from these chance results to breed up suitable chicks until the magnificent type shown by our illustration has been reached.

It is somewhat remarkable that, notwithstanding that the breed is fairly established—that is, that the progeny came true to type, the numbers beyond the confines of this Colony are extremely few. I believe I am correct in stating that the Victorian show catalogues do not contain a class for Australian games, and this is a state of affairs which I should be glad to see altered, as it is certain that the breed has only to be known to be appreciated by all true breeders.

In the article by Mr. W. H. Webb, already referred to, that gentleman says: "They are much heavier and stronger than the British, and not so coarse as the Malay. They are extremely hardy, never giving any trouble from the first, but grow quickly, get their feathers easily, and at an early age are able to take care of themselves. They are splendid layers, and stand among the best for the table. To give the readers of the *Mail* an idea of the size they may be bred to, I have only to say that I have frequently seen the birds turn the scale at 10½ lb. to 11 lb., and one exceptionally large fellow that was bred by Mr. Thompson, of Pennant Hills, turned the scale at 11½ lb. when about 3 years old. The young bird that won the championship prize at the last great show of the New South Wales Poultry, Pigeon, and Dog Society, and which was the foundation of the illustration in this issue, turned the scales at 9 lb. 12 oz. when exactly 10½ months old."

While agreeing in the main with all Mr. Webb claims, I should like to reverse his sentence, and say, "they are splendid birds for the table, and among the best for layers." As regards breeding, the same colours are obtainable as in British games, and some of the varieties are very handsome. I must admit that they are somewhat voracious feeders, but this is a good point when they are chicks, tending to early maturity, and can of course be kept in check with regard to adults. The hens lay an egg rather larger, though similar in shape, to the British game, and they are excellent mothers. The fighting qualities of the hens are really remarkable; my experience is that they fight better than the cock birds. As Mr. Webb has stated, they

mature quickly, and a five months old chick is not only a tender, but a large and weighty roast. There is an abundance of breast meat, white and delicate, and each leg forms a substantial meal for a hungry man. Under all the circumstances I feel perfectly justified in recommending farmers in any part of the country to have a few Australian games, as, outside the value as thoroughbreds, a young reachy cock is most useful in reviving the stamina and improving the size of common hens. Amongst our most successful breeders may be mentioned Mr. Thompson, of Pennant Hills; Mr. D. Pye, of Blacktown; Mr. S. R. Watkins, of Seven Hills; and Mrs. W. H. Webb, of Bathurst.

I append the details attached to Mr. Webb's article of the points and feathering.

General characteristics of Cock.

Head, rather long and fairly thick; beak, very strong, slightly curved, and especially stout where set on; comb not to grow on poll; face, deaf ears, and throat red, fairly smooth, and not too fine in texture; eyebrows, slightly lowering; neck, long and slightly arched; hackle, short; body, stout and strong, largest at shoulders, and taper back to tail; back, flat, widest at shoulders, strong at hips, and taper off towards tail; shoulders, high and square; breast, hard and full, but not deep; the saddle fairly narrow; the feathers short, like hackle; wings, very strong, fair length, and the points well clipped under the saddle feathers; legs and thighs, fairly long, round, and hard; shanks, fairly long and beautifully scaled, roundish, neither flat nor quite round, and strong; spurs, set low, and to point rather backward; feet, flat; toes, fairly long, straight, and strong, well-spread and medium talons, the hind toe to come straight backward and nearly flat out from the foot; tail, moderate in length, not too close nor too much spread, and carried slightly drooping; the sickle feathers to clear each other, and slightly curved; plumage, sound, glossy, and hard; size, large—ranging from 8 lb. to 9½ lb. at 10 to 12 months old, 9 lb. to 10½ lb., with more age; general appearance, strong, active, and vigorous; carriage, upright, smart, and bold.

General characteristics of Hen.

Similar to those of the cock. The comb must not grow to poll, should be small, and come back to a point with tiny indentations. What is required is often described as a "pea" comb. Size, large, ranging from 6 lb. to 8 lb.

Colour of Black-reds.

In both sexes—Beak, dark horn colour; whole face, comb, and deaf ears rich deep red; eyes, pearl, willow, or daw; shanks, willow or olive. Colour of cock, head and hackle deep red, both same shade preferred, free from stripes or spots; back, shoulder-coverts, and wing bow, dark red; wing-coverts, forming bar across wing, steel blue; secondaries, deep bay on outer web (to blend with saddle hackles), the bay is all that can be seen when the wing is closed; black on the inner web, with a black end to each feather, forming a black edge to corner of the wing; primaries, black, with a deep bay edge on outside web; saddle, deep rich red, approaching maroon; breast and under parts, rich glossy black, with greenish shade; tail, black, glossed with green. Colour of the hen—Head, brown; neck, yellow, striped with black; throat and breast, dark salmon, running into ashy colour towards the thighs; body, brown partridge appearance, free from distinct stripes or pencillings, except on the larger tail feathers, where some approach to bars is generally seen.

Standard of perfection.

A perfect bird in shape, size, colour, condition, and hardness of body and feather, &c., to count 100 points.

Defects to be deducted.

Bad head, say 8 points.
Too much hackle, say 12 points.
Tail too long (5), cocked (10), 15 points.
Leg too thin (5), or flat-shinned (15), 20 points.
Imperfect feet, say, 12 points.
Eyes wrong colour, say, 8 points.
Other minor faults in colour, 15 points.
Want of size, say, 20 points.
Want of symmetry or strength, 20 points.
Want of condition as to appearance, 15 points.
Want of hardness on handling, 15 points.

Disqualifications.

Crooked back, crooked breast, duck-feet, wry tail, or any other evident weakness or deformity. Comb growing to poll, single British comb on hen, feathers on legs, any fraudulent dyeing, dressing, or trimming beyond the recognised dubbing and dressing of the head of cocks, colour of legs not matching in show pen.

Notes.

Worms in Fowls.

The following information was supplied to a correspondent who reported that some of his birds were suffering from worms: "If you suspect worms to be common in your run, go over the whole place (ground) with concentrated solution of sulphate of iron; also whitewash the roosts and shelters. A better way still is to change the location of your run. Fowls get worms by eating particles of their own manure. Care should therefore be taken to remove the manure at the very least once per week if the fowls are in a confined place."

In addition to the above it may be mentioned that worms are often caused by feeding birds on a dirty run where particles of the manure adhere to the food. It is also a good plan, as previously recommended in the *Gazette*, to scatter powdered quicklime after cleaning up the droppings.

In the case of a bird known to be suffering from worms it may be well to mention that a capsule of turpentine followed by a small dose—about a teaspoonful dissolved in water—of Epsom salts will generally effect a cure, while for less serious cases a little grated areca nut, sufficient to cover a threepenny piece, will be found beneficial.

General Notes.

Vines in the Corowa District.

In his report on the Murray River vineyards, published in vol. I, Part 3 of the *Gazette*, Mr. Despeissis refers to some of the vines in the Glenhope vineyard, as apparently suffering from Tylenchus or root gall. At his suggestion some of the roots were forwarded to the Department for examination, when Dr. Cobb reported that he failed to find any sign of gall worm in the rootlets submitted. The publication of this statement is the result of an application by the President of the Corowa Winegrowers' Association, the members of which feared that the earlier statement in the report, unaccompanied by the result of the examination might cause injury to the wine trade of the District. It may be added that M. Despeissis visited the vineyard again early in January last, and found the vines perfectly healthy and thriving.

Frauds on Agricultural Societies.

That fraud is perpetrated in exhibiting at Agricultural Societies' shows has long been a patent fact to all show officials, but the difficulties of detection seldom permit of its being brought to light. The lengths to which unscrupulous exhibitors will go, is amply demonstrated by an occurrence at the late show of the Wollongong A. H. and I. Association. The case came under "farm produce," "collection of, from seeds in 1 lb. bags," and the condition was that all the exhibits in the section must have been grown by the exhibitor. There is no necessity to republish names, as the whole details have already been published in the *Illawarra Mercury*. Our desire is simply to record that wrong-doers have been brought to justice. The facts are shortly that the steward of the section, after the judges had reserved their decision pending evidence of growth, cut open a bag of prairie grass, and found in it the card of a well-known Sydney tradesman. Upon this discovery the judges promptly disqualified the whole of the exhibits in the section. Evidence was subsequently obtained of the arrival of a bag of seed from Sydney, and of its receipt by the exhibitors. These facts having been proved to the satisfaction of a special meeting of the Association the exhibitors were disqualified from exhibiting for the next five years, and all moneys awarded to them were withheld. It is to be hoped that this satisfactory termination to a disgraceful attempt at fraud will have a salutary effect upon all who thus attempt to injure the district in which they reside.

National Prizes for Mixed Orchards.

The report of the Judge, Mr. A. H. Benson, of mixed orchards under 10 acres in extent, entered in connection with the National Prize Competitions for 1892, has been duly received and submitted to the Minister for Mines and Agriculture, who has approved of the following awards, in accordance with the recommendations of the Judge:—

1st prize.—Mr. John Hayes, Rockview, The Bulga, Singleton.
2nd prize.—Mr. John Linton, Camden.
3rd prize.—Mr. Thomas Robert Porter, Pymble.
4th prize.—Mr. Caspar Hergenheim, Bega.
5th prize.—Mr. George Smith, Oak Farm, Goulburn.
6th prize.—Mr. George Bool, Parkesbourne, Breadalbane.
Highly commended.—Mr. John Peckham, Guildford; Mr. Thomas Miller, Poplar Grove, Tenterfield; Rev. Joseph Dark, Rotherwood, Mittagong; Mr. John Allison, Eglinton, Bathurst; Mr. Wm. H. Matthews, Cootamundra; Mr. J. E. Barnes, Cootamundra.
Commended.—Mr. H. H. Cooke, Parkes; Mr. Joseph Fuller, Castle Hill; Mr. John Harry, Evergreens, Crookwell; Mr. D. H. Warby, Ingleburn.

It should be mentioned that this competition embraces orchards situated in all parts of the Colony, and is not like some of the others confined to one district.

National Prizes for Mixed Farms, Southern Table-land.

The report of the Judge, Mr. J. A. Despeissis, of mixed farms in the Southern Table-lands, has been duly received and submitted to the Minister for Mines and Agriculture. The competition is divided into two classes, Class I being for mixed farms of any size up to 200 acres; and Class II, farms over 200 acres, and the Minister has approved of the following awards, in accordance with the recommendations of the Judge:—

Class I:—
1st prize.—Mr. G. K. Green, Tumut.
2nd prize.—Mr. Wm. Grant, Mudgee.
Highly commended.—Mr. Wm. H. Bridle, Tumut; Mr. Alfd. Bugg, Breadalbane.

Class II:—
1st prize.—Dr. H. Wharton Mason, Tumut.
2nd prize.—Mr. T. C. Warboys, Springhill.
3rd prize.—Mr. Ch. Loiterton, Cootamundra.
4th prize.—Mr. Geo. Rowlands, Rockville, Mandurama.
5th prize.—Mr. Wm. Corby, Cootamundra.
6th prize.—Mr. Wm. T. Storrier, Goulburn.
Highly commended.—Mr. A. Davis, Tumut; Mr. John J. Miller, Cootamundra; Mr. Ch. Miller, Cumnock; Mr. R. Matuschka, Jindera.
Commended.—Mr. Edw. Taylor, Young.

NATIONAL PRIZE FOR ENSILAGE.

THE following awards, recommended by Mr. J. L. Thompson, have been approved by the Minister in the ensilage competition for National Prizes. There were only two entries, and the following statement shows the scale of points and the number awarded in each case:—

	Max.	Dymock.	Gatenby.
I.—Economy of construction of sil or stack	15	14	14
II.—Facilities for filling sil, or building stack ...	10	9	9
III.—Suitability and fitness as to maturity of fodder for ensiling...	10	10	7
IV.—Utilisation of waste product of the farm for this purpose	10	8	7
V.—Facilities for giving pressure, mechanical or otherwise	10	10	9
VI.—Facilities for removing silage from sil or stack	10	9	9
VII.—Condition of silage on inspection...	20	16	14
VIII.—Freedom from waste	15	10	12
	100	86	81

The first prize has been awarded to Mr. D. L. Dymock, of Marshall Mount, near Albion Park, and the second prize to Messrs. N. A. Gatenby & Co., of Jemalong, Forbes.

THE CARRIAGE OF DAIRY PRODUCE.

ALTHOUGH very much has been done by the steamship companies, with a view to delivering in good condition the perishable freight carried in the cold storage of their vessels, the steps recently taken by the New Zealand shippers for effecting improvements are certainly worth consideration by the officials of the lines trading with Australia. It was found that in many instances cargoes did not reach London in good condition, notwithstanding the low temperature which was maintained. It was decided that the reason for this deterioration was the absence of ventilation in the freezing chambers, with the consequence that practically the same air was used over and over again, with all the exudes co-mingled. In fact, on arrival in England the refrigerated air is almost devoid of oxygen, its place being taken be acidulated gases emanating from the cargo. With a view to insuring better provision for their goods the New Zealand Middle Island Dairy Association despatched Mr. Wm. B. Walters to England, to confer with the owners of vessels engaged in the New Zealand trade, and to supervise the necessary alterations on their agreeing to have such made. That gentleman appears to have been very successful in the case of the "Shire line," whose vessels are now fitted with pipes in connection with the holds, through the trunks at the bottom, and made to discharge into space the obnoxious gases. New ascension air-trunks and *vice versa* have been constructed connected with the main pipes in the engine-room, having controlling doors. It is hardly necessary to add that the New Zealand shippers give preference to vessels fitted in this manner, and, doubtless, similar improvements effected in the Australian liners would insure increased and regular cargoes from New South Wales and Victorian dairies.

Treatment for Anthracnose.

The following satisfactory notes have been received from vine-growers in connection with the treatment for anthracnose recommended, their reproduction being with a view to induce others to try the treatment on any vines they may have similarly affected.

Mr. F. Wooster, of Carlingford, reports that he dressed his grape-vines—white muscat of Alexandria, and black muscat—for authracnose as directed by the Department, giving two dressings of the sulphate of iron solution in the winter, the last when the buds were an inch long.* He also applied Bordeaux mixture once before the setting of the fruit and once after, but not while the vines were in bloom. The different muscats and the white sherry grapes are this year perfectly clean and fit for market, bringing high prices, although he had been able to sell none for the previous three years.

Mr. C. J. Palmer, The Pines, Riverstone, says: "Your advice as to treatment of vines for anthracnose was faithfully followed by me with great success. Last year my muscat vines, 2,000 in number (which are trained gooseberry-bush fashion) were so badly affected with the disease that the average return was not over 1 lb. of berries per vine, and the bunches straggling, and berries inferior. This season, though the disease is still in the vineyards to a slight extent, the yield is 5 or 6 lb. of a splendid sample of grape. As a test I left two rows (each thirty-eight vines) in the centre of the bed, untreated by the sulphuric acid wash, and one of those two rows unsprayed. The result is a proof that the winter wash is the main remedy, although the spraying alone was beneficial. I should mention that through my fear of the poison (bluestone) being left on the berries after ripening, I did not spray after 1st November. Please note in the *Gazette* if there is danger. I am very grateful for your advice which has saved nearly £100 to me for the single season."

With regard to Mr. Palmer's query, the pathologist states that the mixture containing bluestone may be used with perfect safety up to within six weeks of the time the grapes ripen, while the ammonio-carbonate of copper mixture may be sprayed up to within a fortnight or three weeks of ripening. It is a good plan to commence with the former, and finish off with the latter.

It is satisfactory to note that in the Carlingford district alone, those who had only partially sprayed had a fairly good crop, while others in adjoining vineyards who did not take any trouble in the matter, had not a bunch of grapes for market.

Increase of Spraying.

As showing the growing interest amongst fruit-growers in connection with the damage done by insects, and fungus pests, it may be noted that something like 150 spraying machines have been sold by two of the principal firms of agricultural implement sellers in Sydney during the past few months, and there is a large and increasing demand. This is mainly due to the action of the Department, in advocating the use of spray pumps for applying the various remedies for insect and fungus pests recommended by its experts.

* This is too late, and might lead to injury to the vines. The time is when the buds are just about to burst.

Keeping Lemons.

A communication has been received from Mr. C. B. Cairnes, of the Bank of New South Wales, Parramatta, that should be of great interest to lemon-growers as it is further proof of the length of time that lemons can be kept if only carefully handled. Mr. Cairnes placed five cases of lemons in his cellar on 1st August last, and there was only a loss of twelve lemons in ninety days, and the lemons were then in good shipping condition. Mr. Cairnes also mentions that Messrs. Balchin, Johnston, & Co., of Sydney, will put £500 into a syndicate to ship lemons to San Francisco if growers will come forward and subscribe to the same amount. This firm tested the San Francisco market last year with very satisfactory results, so that this offer should certainly be worth the lemon-growers' attention, especially as the lemon is becoming somewhat of a drug on our local markets.

Bush Fires.

The particularly careless manner in which fires are lighted and left burning in the bush has been exemplified by instances recently reported to the Department of Agriculture. That this practice is so common would lead to the supposition that the "Careless use of Fire Act" has practically become a dead letter. As it is probable that this Act will of necessity require to be energetically enforced, it may be well to call attention to the penalties which may follow any breach of the Act, and to give a short *resumé* of its provisions. The clause (No. 1) which may be taken as that generally expressing the objects of the Act, sets forth that if any person shall, except as hereinafter provided, ignite, or use, or carry when ignited, any inflammable material within twenty yards of any growing crops or stacks, or within three yards of any stubble-field or grass land, and thereby the property of any other person shall be injured or destroyed, he shall forfeit and pay for any such offence any sum not exceeding £50, or be imprisoned with or without hard labour for any period not exceeding three months. Or if any person shall leave unextinguished any fire he may have lighted, he is liable to a fine not exceeding £10, or to imprisonment not exceeding one month. There is a provision that when an occupier desires to do any necessry burning off he shall be at liberty to do so on clearing a space of not less than 15 feet in width round the straw, stubble, grass, or herbage intended to be burnt, or wood or other inflammable material intended to be ignited, and giving at least twenty-four hours' notice in writing to all adjoining occupiers of his intention to so burn or ignite. Any penalties under this Act may be recovered in a summary way before one or more Justices of the Peace, and moreover, any offender in any above-mentioned respect may be apprehended without warrant by any person who witnesses such offence, and handed over to some constable or other peace officer, to be dealt with according to law.

The necessity for care becomes greater between the months of October and February, as during that period not only is herbage usually dry and easily ignited, but there is the additional risk of damage being done to growing crops of cereals.

A suggestion that has been made, that all burning-off should be prohibited during the period from the middle of October to the middle of February, thereby reducing to a minimum the risk of loss of wheat crops

by fire in the manner that has unfortunately and regretably been the case for several years past, would doubtless act oppressively in some districts, and therefore would not meet with general favour. Besides, the suggestion, however appropriate, could not be put into operation until the amendment upon the existing Act of Parliament had received legislative sanction.

Manuring Grass Lands.

The following experience of Mr. James Wilson, of Bellowangarah, Berry, of the benefits of manuring grass lands should be an incentive to graziers to pay more attention to this somewhat neglected branch of industry. In answer to inquiries by the Department, Mr. Wilson writes:—"When acquired by me the land was in an almost unimproved condition, the original owners having selected it, and, after ringbarking the hard wood, having done little else to it. I found many trees were too large for cross-cutting, and so fire was resorted to for the destruction of dead timber, the stumps being partly grubbed and partly burned out. The ashes were spread evenly over the surface. The surface stones (porphyry and basalt) were collected into crossings in unnecessary water-courses to catch the wash, and have now caused these to be filled up, so as to form steppes of good productive land. All stones not so used were gathered into mounds or cairns. On the slopes below these mounds the earth seems specially fertile. Then, after ploughing to a depth of 8 to 10 inches, I sowed one crop of oats, which did much to destroy ferns and other weeds. Before this sowing I thinly spread the ground with hair, spent lime, and leather shavings, procured from the local tannery. Next year the ground received a good surface dressing of crushed bones to the extent of 8 cwt. per acre, then was cross-ploughed, and again cropped with oats (for ensilage). The bones were collected from local abattoirs and from the back yards of the local hotels and boarding-houses, and were crushed in an extemporised bone-mill that had formerly been a bark-mill. Thus the cost of each ton when crushed was kept down to from £1 10s to £2. The land was then laid down with 4 bushels of perennial rye grass mixed with 1 of cocksfoot to each 2 acres. By the sward of grass gained by this treatment the land was effectually cleared of ferns and most other weeds, also inferior native grasses. I irrigated the paddock by conducting water through surface drains (mostly plough furrows) from a perpetual stream in the high lands of my farm, and found that the return from attention to this repaid many times the expenditure of money and labour in maintaining and regulating the supply drains. In fattening cattle I find that the pastures in paddocks treated with bone manure produce a good firm meat and a solid firm white kidney fat. After six years' grazing, when the sward was thinning, I closed the paddock till the seed fell. Before my improvements 3 or 4 acres would have been required to carry a beast, whereas now 2 acres can easily carry an ox or more."

Unripe Maize.

The floods in the North Coast District have, doubtless, been responsible for the bad condition of a large proportion of the maize lately sent to the Sydney market. It would seem, however, that prices have been further interfered with by the forwarding of unripe samples from places where the floods have not affected the crop to any serious extent.

The risks of the maize farmers on the low-lying tracts of land adjacent to our northern rivers are well understood. In some cases the crops over which the flood-waters have passed must be sent to market, whatever prices they bring, but those farmers who rush in supplies of unsuitable grain when they have opportunities for allowing it to become thoroughly matured are acting in direct opposition to their own interests.

It has been brought under the notice of the Department by persons of unbiassed opinions and deeply interested in the trade, that maize has in many instances of late been thrashed and forwarded in such a state as to be unable to resist the attacks of mould, even during the time of transit. Such samples can only have the effect of seriously bringing down market values, and a shrinkage of as much as 2s. a bushel is a loss which the farmers, under any circumstances, can ill afford. It is hoped that a word of warning will be received by them and acted upon.

Durable Whitewash for Farm Buildings.

Take one half-bushel of unslacked lime; slack it with boiling water, cover it during the process, to keep in the steam. Strain the liquid through a fine sieve or strainer, and add to it a peck of salt, previously dissolved in warm water, 3 lb. of ground rice boiled to a thin paste, one ½ lb. of powdered whiting, and 1 lb. of clean glue which has previously been dissolved by soaking it well, and then hang it over a slow fire for an hour in a small kettle within a larger one filled with water. Then add 5 gallons of hot water to the mixture, stir it well, and let it stand for a few days covered from dust. It should be put on hot, and for this purpose it can be kept in a kettle on a portable furnace. It is said that a pint of the mixture will cover a square yard on the outside of a house. Fine or coarse brushes may be used, according to the neatness of the job required. It answers as well as oil paint for wood, brick, or stone, and it is cheaper. It retains its brilliancy for many years, and some farmers in America who have tried it say there is nothing of the kind that will compare with it, either for inside or outside walls. Colouring matter may also be put with it to make any shade desired.—*The Australasian.*

Vegetables and Artificial Manures.

A farmer who is growing cabbages and cauliflowers on a large scale near Burrawang for the Sydney market, writes to say:—"I never used manure until I began to read the *Gazette.* I bought £50 worth this last six months, and am highly pleased with the result. Cabbages are becoming a very important crop in this District." Some time ago we visited this farmer, and found him growing crops of cabbages with the aid of imported manures, which were sold at £13 10s. a ton. He was using 5 cwt. per acre, and was satisfied with the results, which generally averaged from 16 to 20 tons of cabbages and cauliflowers per acre. An analysis of this manure showed that it was very much inferior to Colonial manures made from waste products in some of our manufacturing industries. Its manurial value, calculated on local rates, was only £4 16s. a ton. A few experiments soon convinced this farmer that the No. 3 manure made by the Colonial Sugar Company and the P.B.B. manufactured by the Meat Preserving Company, were superior to the imported manure he had been hitherto using, and were available at less

than half the price. The results have been so satisfactory in a pecuniary sense that he and his neighbours are large consumers of home-made manures. The effects are to provide more work for the teamsters who carry these crops, averaging 20 tons to the acre, to the Moss Vale railway station, more freight to the Railway Department for the manure and the resulting vegetables, more business for the Sydney agents, a profitable market for the waste products of the manure manufacturers, less cabbages and cauliflowers to be imported from Victoria, and a fresher and better article sold in our markets.

Rubber Trees.

In Vol. II, Part 3, appears a report by Mr. F. Turner, on the growth of trees in Australia, suitable for the production of india rubber. This was prepared at the instance of the late Mr. Griffin, then U.S. Consul in Sydney, who was engaged in inquiries relative to a source of supply of india-rubber to supplement the production in America. This report has been reproduced in a volume of special reports by United States Consuls in various parts of the world on the india-rubber tree and india-rubber manufactures and trade, published by the Department of State at Washington.

Beekeepers Convention.

A grand convention of beekeepers will meet in Sydney, on the 28th, 29th, and 30th of June next. The meetings will be held in the Girls' High School Building, Elizabeth-street, and the Minister for Mines and Agriculture (the Hon. T. M. Slattery) has consented to inaugurate the proceedings. The subjects for discussion during the convention are points in judging, foul brood and diseases, organization of beekeepers, conservation of forests, adulteration of honey, marketing honey; and as every effort is being made to insure the comfort of delegates, it is anticipated that the convention will be highly successful and beneficial to the apicultural industry. The Hon. Secretary is Mr. C. Mansfield, of the Hunter River Apiary, Largs, Maitland, who will be pleased to furnish any further information.

AGRICULTURAL SOCIETIES' SHOWS, 1893.

Society.	Secretary.	Date of Show.
*Upper Hunter P. and A. Association, Muswellbrook ...	P. Healey ...	May 3, 4
Warialda P. and A. Association	W. B. Geddes ...	May 3, 4
Williams River A. and H. Society, Dungog	W. A. Smith ...	May 3, 4, 5
Coonamble P. and A. Association	F. R. Salt ...	May 10, 11
Hawkesbury District Agricultural Association	C. S. Guest ...	May 11, 12, 13
*Gunnedah A. and P. Association	F. P. Brigstocke	May 17, 18
*Central Australian P. Association, Bourke	J. P. Martin ...	May 31, June 1
Warren P. and A. Society	F. C. Thompson	June 7, 8
Nyngan P. and A. Society	E. H. Prince ...	June 14, 15
Cobar P. and A. Association	A. Roxburgh ...	June 21, 22
Deniliquin P. and A. Society	H. J. Wooldridge	July, 20, 21
Riverina P. and A. Society, Jerilderie	M. Curtin ...	July 25, 26
Gwydir P. and A. Society, Moree...	S. G. Cohen ...	July 25, 26
Condobolin P. and A. Association	A. James ...	Aug. 1, 2
Corowa P. A. and H. Society	A. A. Piggin ...	Aug. 2, 3
Narrandera P. and A. Association	J. F. Willans ...	Aug. 2, 3
Forbes P. A. and H. Association	W. G. Dowling..	Aug. 10, 11
Grenfell A. and H. Society	G. Cousins ...	Aug. 18, 19
Northern Agricultural Association, Singleton	C. Poppenhagen	Aug. 23, 24
Cootamundra A. P. H. and I. Association	T. Williams ...	Aug. 30, 31
Murrumbidgee P. and A. Association, Wagga Wagga...	H. T. Davidson	Sept. 6, 7
Albury and Border P. A. and H. Society	G. E. M'Kay ...	Sept. 13, 14
Burrowa P. A. and H. Association	J. H. Clifton ...	Sept. 14, 15
Junee P. A. and I. Association	M. H. Davies ...	Sept. 20, 21
Yass P. and A. Society	B. A. Nicholls...	Sept. 20, 21

* These Societies get National Prizes.

[Six plates.]

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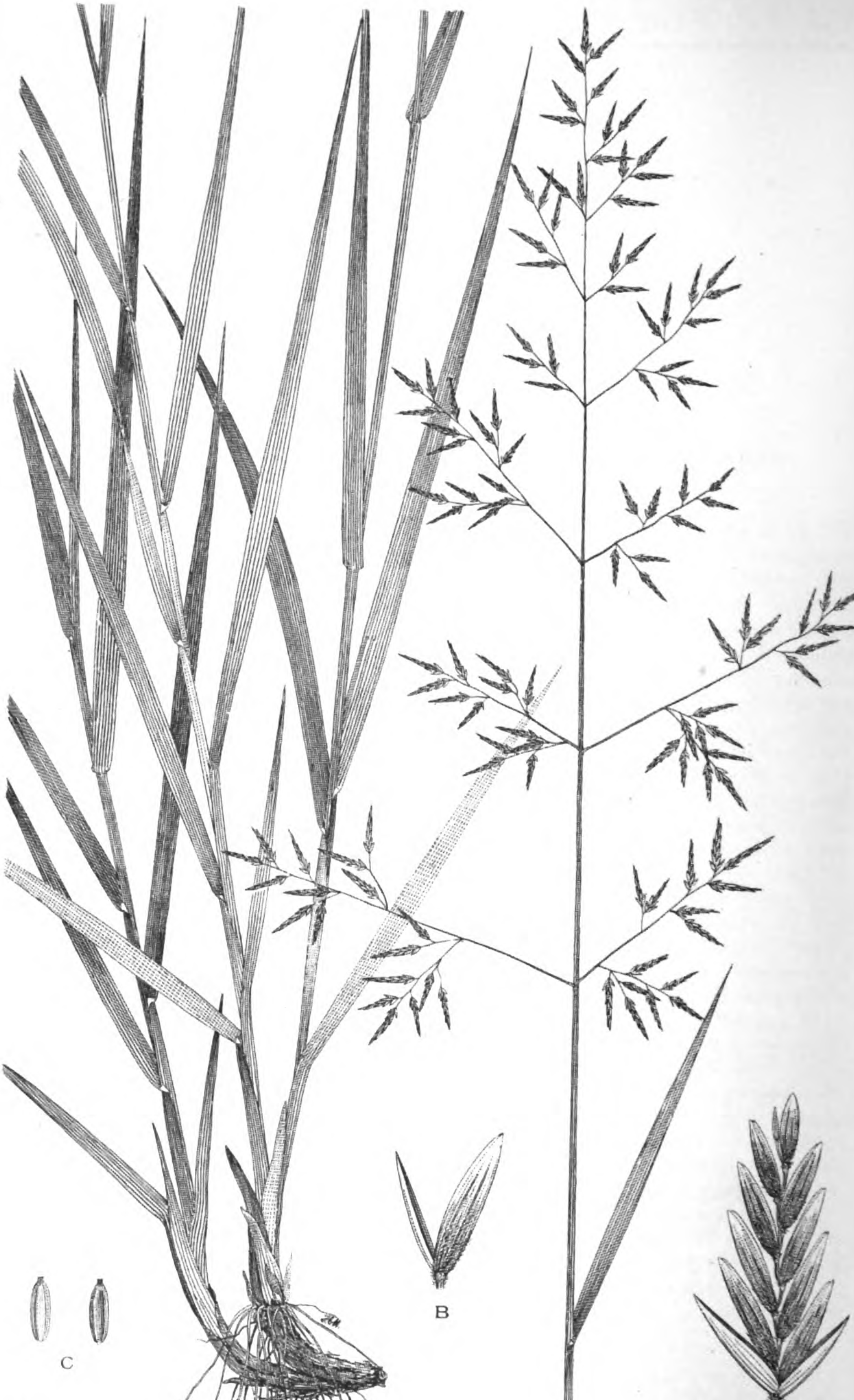


Glyceria fordeana, F. v. M.

"Sweet Swamp Grass."

The Grasses of Australia.

(*Continued from page* 306.)

By F. TURNER,
Botanist, Department of Agriculture.

GLYCERIA FORDEANA, *F.v.M.* "Sweet Swamp Grass."
Flora Austr., Vol. VII, page 657.

An erect glabrous grass attaining 2 or 3 feet, leaves flat, scarcely pointed, sometimes very scabrous. The ligula jagged and conspicuous. Panicle very loose, compound, 4 to 8 inches long, with very spreading capillary branches, mostly in pairs or threes. Spikelets lanceolate, mostly 4 to 5 lines long, eight to twelve flowered. Outer glumes acute, three-nerved; flowering glumes five or seven-nerved, 1½ lines long, surrounded by a tuft of hairs and shortly hairy or pubescent in the lower part, the mid-rib prominent but not reaching the obtuse hyaline apex, the lateral nerves shorter, palea keels scarcely ciliate. Grain glabrous, enclosed in the flowering glume and palea, but free from them.

This perennial grass is found in nearly all the Australian colonies, but principally in the interior, and generally in or near moist places, or on land that is liable to periodical inundations. In many parts of the country it is very plentiful, but this may be accounted for by the fact that under ordinary circumstances it produces an abundance of seed which, when ripe, germinates readily should the conditions be favourable. In very dry seasons, in some situations, the herbage is often scanty and rough to the touch, but under more favourable conditions it is both bulky and succulent. Many pastoralists in the interior justly regard this grass as a most valuable addition to their grazing areas, for in an ordinary season not only does it yield a great amount of herbage, but stock of all descriptions are very fond of it, sheep often eating it down to the roots when there is a scarcity of other feed which sometimes happens where it grows. It is well worth encouraging on low moist lands in the interior to provide feed during adverse times. Good grasses that grow in such situations are a valuable stand-by for stock during drought time, as many Australian pastoralists have learned from practical experience. The seeds of the "sweet swamp grass" usually ripen during the summer and autumn months.

This species was named in honour of Mrs. H. Forde, who found it near the Darling River in 1865. Not only did that lady make an extensive collection of the plants in that then remote part of New South Wales, but under very great difficulties executed some excellent coloured drawings of some of the most typical plants of that region.

Reference to Plate.—A, spikelet; B, floret; C, grain, back and front views, all variously magnified.

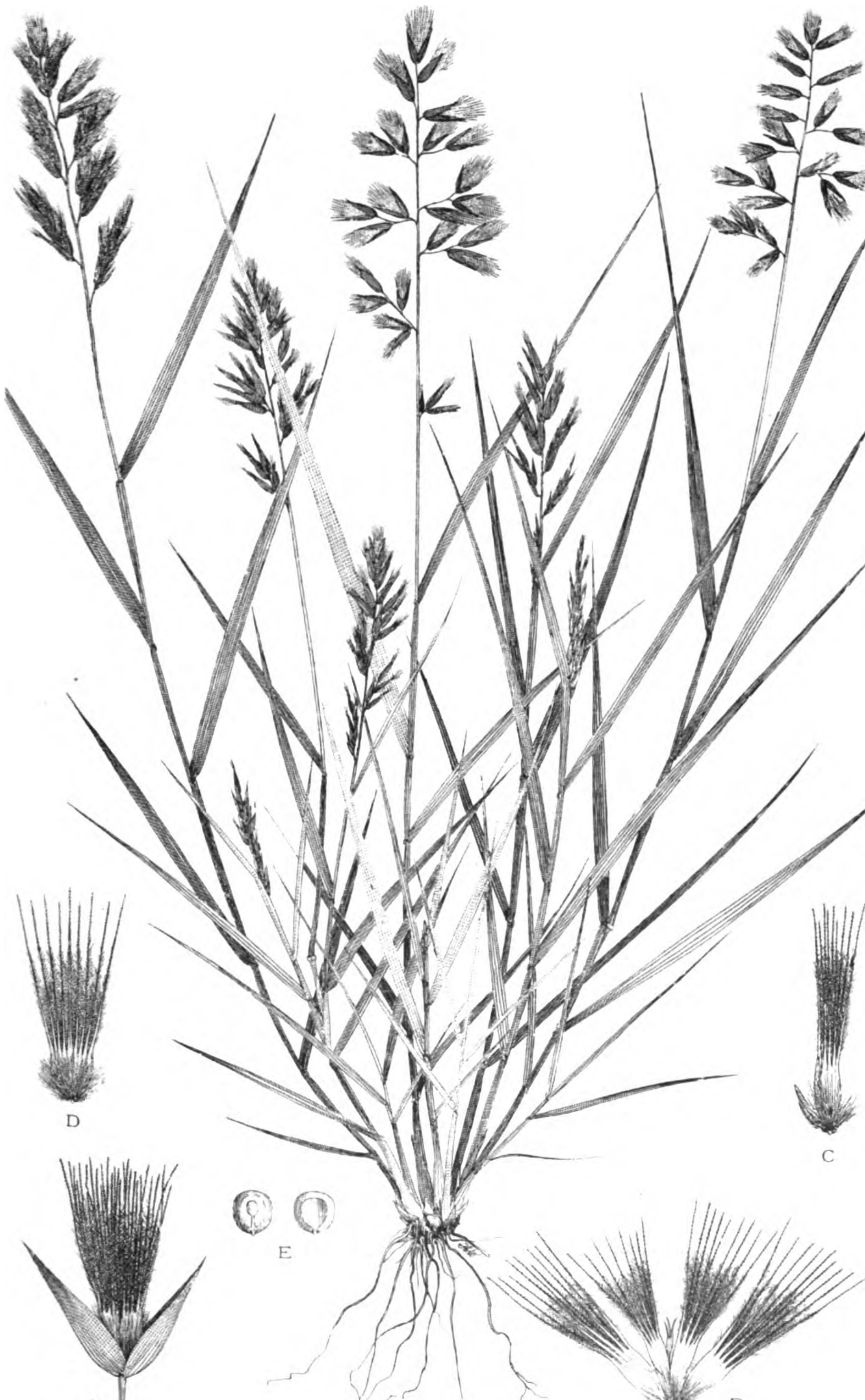
PAPPOPHORUM AVENACEUM, *Lindl.* "Hairy oat grass."
Flora. Austr. Vol. VII, p. 601.

Stems from under 1 foot to 1½ feet high, leaves flat or convolute, usually narrow, sometimes quite setaceous, glabrous pubescent or villous, the nodes glabrous or bearded. Panicle from 1½ to 3 inches long; the spikelets loosely arranged. Outer glumes fully 3 lines long, with numerous nerves, usually more than eleven and sometimes as many as twenty-one. Flowering glumes several, closely imbricate, the outer ones with a fertile flower enclosing one or two with male (or sometimes a second fertile) flowers and one or two empty glumes. The outer flowering glumes usually more than 1 line long, more or less hairy, especially at the base with nine fine spreading plumose awns about 4 lines long. Grain enclosed in the flowering glume and palea but free from them.

A perennial species found nearly all over Australia but principally in the arid interior and in some places very plentifully. It is generally to be found growing on light rich soils or on those of a red loamy character. In very dry seasons it assumes a dwarf tufted habit but under more favourable conditions it grows about 1½ feet high and produces a fair amount of herbage which stock of all kinds seem very fond of. Many pastoralists in the interior regard it as a very nutritious grass, and as it withstands a phenomenal amount of dry weather it is worth conserving in those parts where it may already be growing and disseminating where it does not already exist. Where the grass is allowed to grow undisturbed for a time it produces plenty of seed, so that there would be no difficulty in the way of collecting any quantity for dissemination by those desirous of so doing. The seeds usually ripen in October, November, and December, according to the season. If it should happen to be a wet year, however, the seeds may ripen during the summer and autumn months.

I am often asked the question which is the best way to collect the native grass seeds? In answer to this I have recommended the following as being about the most simple and expeditious way. In the first place, of course, it is necessary to reserve a small or large area, according to requirements, of those grasses it is desired to save the seed of. In a reserve where a number of varieties of grasses are growing together and the seed of one particular species is wanted it will then be necessary to hand-pick it. This no doubt will appear to be a tedious process to the uninitiated, but it is astonishing the amount of seed that can be collected in a very short time by a pair of willing hands. In confirmation of this I may mention the following circumstance: An officer (Mr. G. Valder), of this department, when collecting plants near Tamworth, gathered one bushel of *Danthonia* seed in one hour and a half. If it were not absolutely necessary to keep the different kinds of grass seeds separately they might very well be harvested with an ordinary stripper. With a machine of this description a very great quantity of seed could be harvested in a very short time. The stripper might also be used to harvest the seeds of cultivated grasses. The seed should not be allowed to get too ripe before it is harvested or much of it will be lost in the operation.

Reference to Plate.—A, spikelet; B, flowering glumes opened out; C, floret; flowering glume flattened out, showing the nine fine spreading plumose awns; E. grain, back and front views, all variously magnified.



Pappophorum avenaceum, Lindl.

"Hairy Oat Grass."

Trisetum subspicatum, Beauv.

"Spiked Oat Grass."

TRISETUM SUBSPICATUM, *Beauv.* "Spiked Oat Grass."
Flora Austr., Vol. VII, page 588.

A TUFTED perennial, varying from 6 inches to above 2 feet high. Leaves flat, glabrous or rarely pubescent, the sheaths rather loose, the ligula large and scarious. Panicle dense, almost spike-like, but much interrupted or shortly branched in the lower part, 2 to 5 inches long, silvery-shining as in *Deschampsia*. Spikelets loose and flattened, the lowest outer glume nearly two lines long, the second rather longer, the keel minutely ciliate. Lowest flowering glume sessile above the outer ones, two and a half to near three lines long, the awn sometimes scarcely exceeding it, sometimes twice as long; upper flowering glume smaller, but inserted higher up, so as to be raised to the same level, and sometimes containing only a male flower, the rhachis produced beyond it into a slender bristle, sometimes bearing a terminal empty glume in the Australian specimens. Grain glabrous, enclosed in the glume and palea but free from them, seed not furrowed.

This grass is the only species of the genus found, up to the present time, in Australia, but it is not endemic. According to Mr. Bentham it is a widely spread arctic, antarctic, or mountain species. In Australia it is a purely alpine grass, and, as far as is at present known, found only in the mountainous parts of New South Wales and Victoria. The specimen from which the drawing was made was collected near Mount Twynam. The grass grows both on slate and granite formations, though it is not reported to be very plentiful. It is a very nutritious grass, and, with about a dozen and a half other species, comprises the principal portion of the rich herbage of the high mountain ranges in this country. Mr. R. Helms, an officer of this department, who has recently been collecting plants near Mount Kosciusko, has kindly furnished me with the following particulars regarding the herbage of that part of the country. The area of this highland comprises about 38,000 acres, the greater part of which is splendid grazing country, and covered, on the open parts, with a dense coating of grass, assuming in many parts a carpet-like compactness. Besides the area of the plateau, which is the choicest part of the country, a good deal more land has lately been surveyed adjacent to it, the whole of which comprises over 81,000 acres, and is divided into 22 "snow leases." The land being yearly covered with snow for months has, no doubt, given rise to this term. For five months of the year, viz., from early November till the end of March the pasturage is in excellent condition, and during this time herds of cattle and sheep are depastured upon it when the feed in the low lying plains is getting dried up. There is always an abundance of the purest water to be found all over the district. The highest slopes of the Snowy Range are the most favourable parts for sheep on account of their drier nature and freeness from scrub. The abundance of feed found here everywhere soon puts them into a good condition. On the eastern slopes they often find shelter in the high growing patches of *Danthonia robusta*, which has already been figured and described in the *Gazette*, a grass much liked by them in spite of its coarseness. The valleys and flats in many places are rather boggy for sheep and are better adapted for cattle which everywhere do remarkably well and soon put on condition. The commonest grass of this region is *Poa cæspitosa*. The *Trisetum* produces plenty of seed which usually ripens in the summer and autumn months.

Reference to Plate.—A, spikelet; B, floret; C, grain, all variously magnified.

New Commercial Crops for New South Wales.

(*Continued from page* 225.)

By FRED. TURNER,
Department of Agriculture.

The Cultivation and Uses of the "Chocho" or "Chayote" (*Sechium edule*, Swartz).

The first time that I saw the chocho or chayote was in Covent Garden, London, where it was exposed for sale as a new vegetable. Some years ago it was no uncommon sight to see this fruit on some of the steamers trading between the West Indies, Madeira, and other Atlantic islands, and London.

The chocho belongs to the cucumber tribe of plants, and is a slightly hispid climbing perennial, with large membranous, cordate, angled, or lobed leaves. Flowers yellow, monœcious (*i.e.*, the male and female organs are borne separately but on the same plant), males disposed in axillary racemes, females singly or in pairs in the leaf axils, corolla rotate and deeply five parted. The fruit is fleshy, obovoid, oblong, or pear-shaped, furrowed and one-seeded. There are two varieties, one bearing white and the other green coloured fruits. The latter variety is considered by some persons to be the better of the two as a vegetable. A few authorities say that the native country of the chocho is unknown, whilst others state that it is indigenous to South America. This is of very little consequence, however, from a practical point of view. The plant is now to be found growing in most of the tropical and temperate parts of the earth, and in some countries it is cultivated very extensively both for the sake of its fruits and tubers. The latter often grow to a great size, each one resembling a huge yam both in appearance and in its flavour when cooked. Nearly three years ago Mr. W. Hill, Canonbie Lee, near Brisbane, Queensland, presented two dozen chochos to this department, and these were distributed to growers near Sydney and in the north-eastern portion of the Colony. From these fruits nearly as many plants were raised, and they bore excellent crops in less than twelve months, nothwithstanding that they were grown under widely different conditions as regards soil and climate. Although a number of the fruits, the produce of many of these vines, have been distributed and planted in other situations, still the plant is not yet grown to the extent it should be in this Colony considering the great economic value of its fruits and tubers as food for man and beast. With a view to further encourage the cultivation of this most useful plant the department has procured a number of fruits for gratuitous distribution to growers in suitable districts. Although it has already been proved that the chocho will grow under varied conditions as regards soil and climate, still it appears to grow best and produce more fruit in the coastal districts where the atmosphere is humid than in the drier portions of the Colony. On the eastern side of the Dividing Range from Illawarra to the Tweed the

Sechium edule, Swartz.

"Chocho" or "Chayote."

chocho should be extensively planted where the conditions are favourable. Every farmer and also every person who cultivates vegetables should grow at least one chocho plant, for it may be classed amongst the most valuable of garden esculents. Those farmers who keep a number of hogs might grow the plant on an extensive scale to great advantage. The fruits and tubers are said to be not only excellent feed for swine, but that the animals fatten on them. There are very few quick growing climbing plants of such economic value as the chocho that I could with more confidence recommend for planting to cover unsightly fences, or for training up trellis work to hide unsightly objects, or to grow over arbours, &c., but it should be mentioned that the situation must be well sheltered, for nothing appears to harm the plant more than strong winds. The best time to plant the chocho is in August, when all danger of spring frosts have disappeared. The plant delights in a light open rich sandy loam, but it grows well enough on other soils, provided that they are not too tenacious and are fairly rich in humus. As the young chocho plant developes from the thick end of the fruit care must be taken when planting to lay it on its side with the radicle pointing downwards, and not cover it too deep in the soil.

In the warmer parts of the Colony the plant will, when established, bear fruit more or less nearly all the year round, but, of course, much more abundantly in the summer than in the winter months. In the latitude of Sydney and further to the south the plant will only bear fruit during the summer and autumn months. Sometimes the stems die down to the ground, but on the return of warm weather new growths are quickly developed from the tubers should the latter be uninjured. Even as a honey plant the chocho is not to be despised. In the flowers, especially the females, there are ten well-developed nectar bearing glands in the tube which secrete a lot of honey, and which bees work very industriously.

Diseases, so far as I have observed, the plant appears to be quite free from, also from the attacks of both insect and fungoid pests.

Cooking the fruit.—For cooking purposes the fruit should not be allowed to get too old before it is gathered, or it will be likely to be stringy. I have eaten them cooked in the following ways :—(1) Peeled, quartered, boiled, and served like vegetable marrow ; (2) peeled, quartered, parboiled, and then baked under a joint of meat, and served like baked potatoes. I prefer them cooked and served in the latter way.

As regards the constituents and nutritive value of the chocho I cannot do better than quote Dr. Helms' analysis which was made from fruit grown in the Colony.

Six fruits weighed	1·22 kilo.
Average weight of one fruit	203·3 grammes.

Analysis.

Moisture	85·95 per cent.
Ash (inorganic substances)	0·51 ,,
Organic substances	13·54 ,,
	100·00 per cent.

The 13·54 per cent. organic substances contain 0·2322 per cent. nitrogen equal to "Crude Protein" (with 16 per cent. N.)	1·451 per cent.
Carbohydrates (Calculated as glucose)...	6·005 ,,
Substances free of nitrogen, other than carbohydrates, and woody fibre (by difference)	6·084 ,,
	13·540 per cent

Calculated for the dry substance (*i.e.*, 14·05 per cent. of the original substance)		
Nitrogen	1·652	per cent.
Equal to ammonia	2·006	,,
Carbohydrates (calculated as glucose)	42·740	,,
Analysis of "Crude Ash" (*i.e.*, the carbonic acid formed during incineration is not subtracted)		
Insoluble matter	1·70	,,
Phosphoric Acid ($P_2 O^5$)...	11·90	,,
Sulphuric Acid ($S O_3$)	4·21	,,
Chlorine	6·87	,,
Lime (Ca O)	6·18	,,
Potash ($K_2 O$)	37·45	,,
Soda ($Na_2 O$)	8·42	,,

The nutrient ratio, *i.e.*, the ratio between albuminoids and carbohydrates (sugar, starch, &c.) is 1 to 4. The nutrient value is 7½.

Nutrient ratio in potatoes is 1 to 17 and the value 22. That is to say, the proportion of albuminoids to carbohydrates in chochos is nearly four times greater than in potatoes, while the nutrient value of potatoes is three times as great. This fruit approaches more nearly in composition to the cabbage with which its nutritive ratio and value are identical.

Mr. George Valder who has grown the chocho for more than two years, speaks of it in the following terms:—"On the 6th February, 1891, I planted one of the chocho fruits, which were being distributed by the Department of Agriculture, close to a 6-foot fence in my garden at Leichhardt. It germinated in about eight days, and the weather being favourable it grew very rapidly. The plant commenced flowering in the early part of May and soon formed a large number of young fruits, but on the approach of cold weather they dropped off, and the vine began to wither and soon died away. In August, I noticed that the tuber had again commenced to shoot. At first the young shoots grew slowly, but as soon as the hot weather came on they grew very rapidly. At the time of flowering (end of January) this one plant had covered nearly 50 feet of fencing. On the 24th February 2 doz. fruits were picked, the average weight of which was 15 oz. From this time until the early part of June the plant yielded from 3 to 4 doz. fruits per week. A number of these fruits were distributed in the neighbourhood of Sydney, and I have lately seen about twenty plants, that were raised from them, bearing enormous crops. The plants seem to grow better and bear heavier crops when trained over a trellis than in any other position. Many persons who are cultivating this plant simply boil the fruits and serve them up in the same manner as vegetable marrows, but I find that they are much nicer parboiled and fried, or baked in the oven under a joint of meat."

Mr. S. Cheetham, of Callan Park gardens, speaks of the chocho as follows. "I obtained a number of chochos which had been grown from fruits sent out by the Department of Agriculture, and planted them in a hot frame in July. They germinated very quickly and were planted out early in August. I found that the plants grew remarkably well in a deep open soil, against a trellis having a northern aspect. The plants commenced to flower in February, and since then the yield of fruit has been enormous, and at the present time (April) the vines are still fruiting. When the plant is in flower I have noticed that the vines were swarming with bees, and as flowers are scarce in the autumn, the plant will no doubt be valuable as a honey producer. I prefer the chocho cooked in the following way. First parboil, then cut into slices and fry. Cooked and served in this way, they are a

very desirable vegetable, more especially as they crop at a time of the year when other garden esculents are scarce. I also think that the fruits will be valuable feed for hogs. I find that the plants grow best in warm weather, therefore I think that it would be a suitable crop to grow in the warmer portions of the Colony."

Mr. A. Bonnefin says:—"I planted my chochos in August, and the vines commenced to bear six months afterwards. I counted about 300 fruits on one vine. The fruits weighed on an average 8 oz. The vine was trained on a fence. I found those that were planted in the shade did not thrive well."

A writer in the *Town and Country Journal* says, with regard to the chocho:—"As a food, we consider the new introduction likely to prove of great use, not only cooked as a marrow, but as an addition to acid fruits, such as rosella, rhubarb, &c., it is excellent, especially with rosella, as it considerably modifies the, to some persons, exceedingly tart taste of this fruit. As this vine is a prolific and rapid bearer it is well worthy of every attention, and its successful introduction into Australia is another illustration of the necessity for observation of the food products indigenous to other countries, in order that the range of our own food products may be materially augmented."

The Treasury of Botany says:—"The chocho is commonly cultivated in all the West Indian Islands for the sake of its fruit, which is reckoned extremely wholesome, and commonly used there as an article of food by all classes. The generic name is derived from a Greek word, signifying 'to fatten in a stall.' The fruit, besides its utility as food for man, having the reputation of being a very fattening food for hogs and other animals."

Dr. Joseph Bancroft, of Brisbane, who has given much attention to the introduction of economic plants into Queensland, told me that he regarded the chocho as a most valuable esculent.

The Grafton correspondent of the *Sydney Mail* wrote recently as follows:—"This plant was introduced to the Colony by the Department of Agriculture some time ago, and, some of the seeds coming to the Clarence, they were tried with satisfactory results. Mr. O. Fuchs, of Grafton, who conducts an apiary, planted some chocho seeds, which vegetated amazingly, producing millions of splendid blossoms for honey. The plant, which spreads over a large area, commenced flowering at the close of the year, and has been well laden with mellifluous blossoms ever since. The bees are extremely fond of the chocho, and with the apiarist the newly introduced plant must become a strong favourite. It is a prolific fruit-bearer, each vine producing some thousands of a fruit much resembling a lemon. These when boiled are much the flavour of turnips, and make a very good dish. Numbers of the citizens of Grafton who have tried them express themselves as well pleased with the chocho as a table delicacy. Mr. Fuchs generously intimated that he was willing to supply seed to any person desirous of planting. As a consequence there have been applicants from the Hunter to the Queensland border. The plant, though susceptible to frost, is a perennial, and planted in early spring, vegetates with very little trouble. It bears fruit from January till the winter, and the yield of a single vine is prodigious."

Reference to plate.—A, side view of a female flower; B, vertical view of a female flower, showing the ten nectar bearing glands; C, side view of a male flower; D, vertical view of a male flower; E, united stamens, showing the zigzag anthers; F, fruit, all variously magnified with the exception of the fruit which is much below natural size.

Tobacco as a Farmers' Crop in New South Wales.

(*Continued from page* 334.)

BY G. F. SUTHERLAND,
Department of Agriculture.

Selection of Species and Varieties.

THE subject of selection of species has, in a great measure, been anticipated in the earlier portion of this article in which I generally indicated the varieties in common cultivation in other parts of the world, their respective habitats, characteristics, commercial values, and probable homes for adoption in this Colony. Such recommendation is founded upon the axiom that if the qualities of any variety of plant are sought to be perpetuated in a new country it must be surrounded by those particular circumstances of soil, climate, and treatment which had originally produced its special peculiarities.

Although we may not be able to provide all the varieties recommended with these conditions in their entirety, we can offer many of them as good a home as they left. If they do not wholly retain the peculiar merits for which they were originally distinguished, it is quite within the range of probability that with care they may develop other features of equal value in their new abode. The particular sorts of tobacco, the cultivation of which will ultimately prove most profitable in the different districts of the Colony, have yet to be definitely ascertained by actual experiment, as well as the connected question of the relative values of home-grown *versus* imported seed.

With a view to the timely solution of these questions and the encouragement of this industry, the Department of Agriculture is importing a quantity of seed of favourite varieties of each of the classes previously recommended, which will be distributed to such farmers, in approved localities, as will engage to give the necessary attention to their cultivation, and report the results.

It may be safely anticipated that the ultimate outcome of continuous experiment on these points will be the evolution of several new local varieties with specific characteristics, the merits of which will depend upon the judgement and wise selection of the growers in their early stages. The greater portion of the tobacco now grown in New South Wales is from the locally raised Connecticut seed-leaf variety. The original seed of this variety must have been imported a long time ago, as it has developed a bad peculiarity unknown to its American progenitor, viz., inordinately prominent *laminae* or lateral veins, which render it unsuitable for several manufacturing purposes, such as spinning or cigar making. This undesirable development may reasonably be considered as one of the results of its translation from a comparatively poor native soil to the extra rich alluvial flats of Tamworth or Tumut, but in a less degree from this cause than from the persistent habit of

planting year after year from seed raised on the same fields as the crop is grown upon, a practice discarded in every other form of agriculture. Seed for home use should not be grown by the farmer from any strain for more than two years in his own nursery. His annual supplies should either be obtained from an approved seedsman or by exchange with a friend in a neighbouring district sufficiently removed. This Connecticut tobacco is a good cropper, hardy, stands drought well, and matures early. On the other hand, in addition to the demerit of gross veins, it is a low-growing variety, and hence has in common with all such, one-third of its leaves draggled and ground damaged, thus greatly lessening the value of the crop. This fault might be partially rectified by priming higher and topping proportionately. The squatting character of the plant is also objectionable, as affording too favourable a cover for the insect enemies of the tobacco plant. Also, while largely precluding the use of horse implements in its after cultivation, makes hand-labour difficult without injury to the drooping leaves. For these reasons, therefore, a more upstanding tobacco will recommend itself, and such may be found in Cuban, Havanah, or Manilla, suited to the coast districts. Turkish for the slopes of the dividing range, and any broad or medium leaved Maryland or Virginian sort for the interior, to which list should be added varieties of Persian tobacco, recommended by Mr. F. Turner, Botanist to this Department.

The objection to so-called high-growing varieties on account of possible damage by wind may be dismissed with the advice to plant double or treble windrows of sunflowers, which may be utilised for bees and poultry, sorgham for seed and sweetcorn, beans or cucumbers for domestic consumption. The kinds of tobacco commended, if planted at a reasonable distance, will all permit of horse cultivation, instead of manual labour, thus making a very considerable difference in cost of production and consequent profit, without any of the drawbacks of low-growing varieties above emunerated.

Bright-curing tobaccos, such as "white burley"and others, do not retain this characteristic when planted on very rich soil. They are the product of a poorer class of land, similar to the best sandy loam found on the Agricultural College farm at Richmond. The out-turn avoirdupois of this class is, of course, much less than from the heavier types on richer land; but if properly handled the pecuniary return should be equal, if not greater, as the expanding public taste for light mild-flavoured tobacco has at present to be met entirely from abroad.

Disease.

Before entering upon the practical details of cultivation of the plant, it will be advisable to refer to this subject of disease which has proved the most serious evil tobacco growing has had to contend with in this Colony. Although widely diffused it is but little understood. However, it is hoped the following observations and suggestions may help intending growers either to suppress this ubiquitous evil, or considerably lessen its injurious effects.

The tobacco "Mildew" or mould is a fungoid disease which has been known for the last forty years, both here and in Victoria. Apart from the destructive attacks of insects, which, through the medium of the spray pump and insecticides, may be cheaply, summarily, and effectively dealt with, it seems to be the only serious complaint from which the tobacco plant suffers. It is an irregular and troublesome visitor, and has rarely appeared in the malignant form it recently exhibited in the south-west part of the Colony,

where, during the season of 89–90, under an access of predisposing circumstances, it took to itself increased energy, and has thence forward pursued its ravages almost unchecked, except by the curtailment of the area under crop. The most favourable conditions of weather for the successful propagation of this disease appear to be a wet and cold spring with the alternation of hot sunshine and chilly nights. A deficiency of lime and potash in the soil is also supposed to exercise a favouring influence on the development of this as well as other fungi. A modification of this condition of the soil with the application of proper safeguards against the adverse weather complained of may, therefore, be justly supposed to be advisable precautions.

The disease and its probable remedy have seriously engaged the attention of the Department of Agriculture from its inception, and it was one of the earliest subjects dealt with by Dr. N. A. Cobb, the pathologist to the Department, who furnished the public with the results of his investigation in the October number of the *Agricultural Gazette* for 1891,* and it is earnestly desired that growers will, in their own as well as public interests, take the precautions therein recommended for its suppression.

Seed-beds.

Bearing in mind the severe blows which tobacco-growing has in the past received from the forementioned disease, I would impress upon the farmer the necessity of exercising the greatest care in selecting the situation for his seed-bed, on the successful culture of which the very existence of a future crop depends. This may be done to a great extent by avoiding any locality where mould has been known to have recently existed.

In the past convenience largely dictated the habit of making the seed-beds close to the intended tobacco-fields which, if mildew was non-existent, is a very good arrangement indeed. But as the flats devoted to tobacco-culture are throughout the periods of seed germination and early growth of the plant—July till October—generally shrouded in a veritable wet blanket of fog, from sunset to some hours after sunrise, they afford the most favourable conditions for the development of fungoid growths. For this reason that position should be shunned, and I counsel intending growers, even at the cost of some inconvenience to select a higher and healthier situation beyond the prejudicial influences referred to. A sheltered nook on a hill-side with a north-easterly aspect well drained, but with no wash-away, will best answer the purpose. Plenty of such abound wherever tobacco is grown in this Colony, and having selected your ground, proceed as follows:—Two or three months before sowing break up the land intended for the seed-beds to a depth of 18 inches, cleaning out all weeds, stones, and rubbish and as the uplands recommended are generally deficient in the humus necessary to the free uncakeable soil and exceeding fine tilth required for this purpose, it should be added in the form of a well-rotted pig-yard, fowl, or cow-shed manure. That from the stable is not so suitable. This should be dug in and well mixed with the soil, in which condition, save for any necessary weeding, it may remain until the arrival of sowing time. It should then receive a final digging and be laid off into beds, a convenient size for which is 16 ft. or 18 ft. x 3 ft., with 18-in. pathways between, the soil from which to a depth of 6 inches or 8 inches all round, should be thrown upon the proposed beds. This elevation, coupled with the site, should afford perfect drainage. Upon the beds so prepared, pile light brushwood to a

* Reproduced in Vol. IV. Pt. 5, p. 317. The information given in this series of articles naturally travels over much of the ground taken in the joint article by Messrs. Lamb and Sutherland, published in Part 5, but is considerably amplified.—W.S.C.

height of 3 or 4 feet, and burn off. Having removed the charcoal and cinders, the ashes should be well mixed with the surface soil, and the whole carefully smoothed, for which purpose a fine meshed long-toothed rake is best. This burning answers the double purpose of supplying potash in the form of wood ashes to the soil, and the killing of grubs, weeds, and other obnoxious matter, which, if left unmolested, would cause considerable injury, and entail much tedious labour for their removal. Weeding a seed-bed means disturbing the tender roots and seriously interfering with the growth of the seedling. Care should, however, be taken that the brush firing or burning on the beds is not too great or prolonged so as to destroy the organic matter in the soil. The general fashion among tobacco growers in calculating the area of seed-bed required, is to allow 1 square inch to each plant, and sow double the estimated space, which is, I think, a safe and sufficiently liberal plan to meet all reasonable contingencies. However, it is better to err on the safe side and have too many plants than too few. Beds of the area recommended will afford easy growing space to about 7,000 healthy vigorous seedlings. The sowing should be done at intervals of a few days so that the maturing of the seedlings may be distributed over a period that will give the grower ample choice of time for the operation of planting, as well as enabling its accomplishment in instalments, conditions which will also be transmitted to the full-grown plant, and give more time for harvesting. Sow as follows:—To each bed take about 2 teaspoonfuls of seed, and having thoroughly mixed it with a quart of wood ashes and clean fine river sand, sow uniformly over the plot. After this has been done, if the weather is dry, it may receive a light watering from a fine rosehead can, and the surface should then be firmly beaten down with a flat board or the under side of a spade. This operation is important, and should never be omitted. As no feasible precaution likely to prevent mildew should be neglected, I would now suggest the scattering of a thin layer of common chimney soot over the hardened surface of the bed. This matter has a mechanical as well as a chemical action, to one or both of which is ascribed the power of destroying certain forms of fungoid life. No raking or other process is necessary for covering the seed. If the beds are liable to the incursions of poultry or cattle they should, of course, be securely fenced.

As frosts prevail over the greater part of the Colony during the period that the seedlings are being raised, it is necessary to take precautions against its possible attack. Several methods of protection are in use, such as the spreading of rushes and straw over the beds. Whatever merits these preventives may have in other countries, I do not recommend the practice in New South Wales, as on account of the close contact of the rushes with the ground it effectually prevents the access of either air or sunshine to the seed or plant, harbours insects, and, after the periodical waterings, the consequent evaporation chills the ground. This both retards growth, and encourages fungi, the spores of which there is every reason to believe have been largely distributed by this custom and the habit of using these contaminated rushes during successive years.

A much better plan is to well cover the beds with sets of light straw or grass mats, as sun-shades or frost and bad-weather protectors. They should be supported on horizontal poles, running along the sides of the beds a few inches above the ground, these being in turn upheld by small forked sticks, which should be higher on one side than on the other, say 5 inches and 9 inches respectively, to permit the rain to run off. The slope of the mats should be towards that side from which wind and weather are most to be

expected. These screens are very easily and inexpensively made of split sticks or lathes covered with grass or wheat straw, and should be large enough to overlap the bed, when they are an effective protection against frosts or a too powerful sun. They permit a free access of both light and air, the oxygen of which is as necessary as warmth or moisture to the existence of the plant, thus encouraging the growth of healthy hardy seedlings. They are also easily removed when the favourable state of the weather permits, which should always be done. The beds must be kept moist but not wet, nor at any time exposed to frost, rain, or strong sunshine. Watering should always be done in the evening, delivered from a fine rose, held low so as not to disturb or wash away the soil from the tender rootlets. On the appearance of the young plants, which period varies, according to latitude and elevation, from one to six weeks from time of sowing, the shades should be removed and the plants carefully examined once if not twice a day, when insects ought to be searched for and rigorously destroyed, any weeds being also rooted up, replacing the shades when finished. A week or two later surplus plants should be taken away and if carefully pricked out in a spare bed left for the purpose will thrive very well. It is at this stage "Mildew" has been found so destructive heretofore, but it is sanguinely expected, that if the precautions suggested for the spraying of the young plants with either of the fungicides recommended by Dr. Cobb, and the instructions as to site, preparation and the care of the seed-beds here given are strictly attended to, the "enemy" may be kept indefinitely at bay. A strong man will withstand disease better than a weak one and the same fact is equally true of plants. If at this stage they are periodically treated to a watering with liquid manure, prepared either from Peruvian guano, Sugar Company's No. 5 manure or a mixture of three parts fowl droppings to one of wood ashes with a small teaspoonful of powdered sulphur to a gallon of the liquid they will be found to make great strides in growth and vigour and arrive at maturity much quicker than they otherwise would. Care should be taken that the various liquid manures are not supplied too strong or too cold in either of which conditions they will kill or damage the plants. Of the latter compound 1 lb. of solid to $1\frac{1}{2}$ gallons of water answers very well. No. 5, manure and guano may be mixed at the rate of about 2 oz. to the gallon. A good way of obtaining a suitable temperature for the above is to expose the cans containing them to several hours sunshine. The strength not being exhausted from either sediment it may be used for the kitchen garden or any other similar purpose. Seedlings are large enough to transplant when their leaves have attained the diameter of a penny piece and are four in number. The sooner planting is done after the seedling arrives at this stage of maturity the better, as the older and woodier stemmed they get the greater is the difficulty they find in establishing themselves when uprooted from the bed and set out in the fields.

The period of sowing beds will, of course, vary throughout the Colony, the object of the farmer being in each case to get his field planted out as soon after the departure of the spring frosts as is practicable, and also that he may receive the full advantage of the general rains of that season to give his crop a good start, with which view he sows his beds so long as three, four or even five months in advance.

Without being dogmatic on this point I certainly think the period might be greatly curtailed say to ten or eleven weeks. By the system of sheltered beds and stimulating liquid manures recommended, coupled with the practice of starting the seed before sowing, which may be done by mixing it in a canister or jar with the sand it is intended to be sown with, in a slightly

moist condition and keeping the vessel in a uniformly warm (not hot) position for about a week before sowing a considerable saving of time is effected. It is not desirable to permit the seed to sprout in this condition, but only to soften the shell, and thus enable more speedy germination in the nursery. Tobacco seed, under the influence of a cold soil and climate, will not sprout—warmth, air, and moisture are necessary—so the farmer gains nothing by his long anterior winter or early spring preparation, when by waiting for more genial weather, and the practice of the process described, a large saving of time, with better and more certain results, may be expected.

Transplanting.

Before this work is proceeded with, it will be necessary to decide which of the various forms of alignment practised in planting is to be adopted, and also the distance apart at which the plants are to be spaced. We have the choice of laying out in lines, squares, or quincunx, each of which has its merits, but with little reservation the latter commends itself most to tobacco growers, as it not only permits a greater number of plants per acre being set out, but also the option of three angles of cultivation, its drawback being the short turnings for horse and implement at the corners of the fields, which portions, however, may, at little inconvenience, be done with the hoe.

It is of the first economic importance in the work of further cultivation, that where horse-power can be used manual labour should be dispensed with. Hence it is necessary that sufficient space between the rows should be allowed for this and the many other requisite operations in the future cultivation of the plant, such as spraying, pruning, topping, and suckering. The area of space per plant to be allowed is also governed by the quality of the soil, and the class of tobacco grown. In a rich soil the rows must necessarily be further apart than on a poor one. While a small-leaved Turkish plant thrives on 1 square foot of ground, a well-grown Connecticut requires from 12 to 14 square feet. The leaves of some sorts stand at an acute angle, and others at a right angle to the stem, each kind requiring a varying amount of space for its proper growth, so that it is impossible to fix an arbitrary distance. With little exception, however, 3 ft. 6 in. between and in the rows, planted quincunx, will be found a liberal distance for even the most luxuriant growths. When ready to plant, the rows may be run out north and south, making true lines with a light one-horse plough, and by laying a properly-spaced knotted line tightly along the ridge so formed, the positions to be occupied by the plants will be ascertained by the knot mark in the soil. This plan is also followed without the use of the plough furrows, which are, however, to be generally commended. A cloudy or light drizzly day should be availed of for planting out, which will prevent excessive withering on the part of the newly-set seedlings; or in the absence of such weather this work would best be confined to the evening. The soil ought to be moist, but perfectly friable, and no present or future operation should be carried on in a tobacco-field when the ground is wet enough to cake.

Before removing the plants from the beds, these should receive a good watering an hour or so in advance, to permit of their easy extraction without injury to the roots, which work may be variously done, as the uniformity in ripeness of the plants will permit or not. Where a cluster of ripe seedlings exist they may be lifted out in a body with a trowel or spade, but the larger number will have to be taken out singly, to do which they should be gently but firmly lifted out with the fore-finger and thumb, seizing them either by the under side of the two largest leaves, or by the stem near the roots; they should then be placed in a small basket, covered with a wet cloth. If the

spatting of the seed-bed has been done as recommended, at sowing time, it will now be found that a small lump of moist soil will have adhered to the roots of each plant, which will prove of the greatest service in assisting its establishment in the field, which we will take for granted has received a proper preparation, and where, having been conveyed, the seedlings should be gently dropped one by one on the marks left by the spacing-line, and thereafter planted as speedily as possible, which should be done as follows:—Make a small hollow on the east side of the ridge, opposite the knob mark, in the centre of which, with a round pointed stick prepared for this purpose, make a hole large enough to easily receive the root, which, however, should not be buried too deep, nor in any way buckled or doubled up. The soil should then be gently but firmly pressed or worked round the plant, care being taken that no earth, or other matter is lodged on the core or leaves. It should then if necessary receive a little water, delivered low for reasons already stated, and be protected from the sun or late frost by shades of a suitable description, both of which attentions must be continued to the plant till it has thoroughly established itself in its new quarters, which it will accomplish, according to the geniality or otherwise of the soil and climate, within a period varying from three to seven days at latest. By this time it will have become apparent what plants have failed to take root, when the vacancies ought immediately to be filled up with fresh seedlings. Shading the young plants is one of the necessary, but tedious, operations which have made tobacco-growing more or less unpopular with Europeans in New South Wales; there are, however, no certain means of dispensing with this precaution, unless the farmer is favoured with a continuation of cloudy weather at planting time, which cannot be depended upon. The system of planting in hollows on the eastern side of the ridges recommended above, which shades them from the more powerful influence of the afternoon sun as compared with that of the morning will, under certain conditions of the weather, prove sufficient; but it is unadvisable to entirely rely upon this protection, as a comparatively short exposure to a burning sun may undo the work of days or weeks. Saving those parts of the country where the banana grows very little leaf shade is available, hence the habit of using dried or green rushes for this purpose, and with which no fault can be found, if care is taken that they are not made the medium for spreading mildew, which precaution is best effected by thoroughly sterilising them before use, by a few seconds immersion in boiling water, or the application of any of the fungicides recommended in Dr. Cobb's article.

Worming and After-Cultivation.

When the young plant has fairly taken root in kindly ground it thrives well, and grows rapidly under the favouring influences of our spring showers and sun. But, that the greatest advantage may be derived from these, the labour of the grower is still necessary in the varied work of "worming," "keeping an open soil," "hilling," "pruning," "topping," and "suckering," some of which operations proceed contemporaneously, and which I will describe in detail. Under ordinary circumstances, when a tobacco-field has been planted out, the young seedlings become the object of immediate attack by a greater or lesser number and variety of insects, slugs, grubs, and all that tribe, most of which attack the plant above ground, while others, such as cut-worms (*agrotis*), confine their ravages to the underground stem and roots. All of these demand immediate removal before they have damaged, or, may be, utterly destroyed

the plant, which they will speedily do, if left undisturbed. But where either of the fungicides previously referred to has been applied as directed, it is anticipated that little damage will be done by insects at this period, as these mixtures will either make the vegetation it has been applied to extremely unpalatable, or actively poisonous. These effects are, however, only temporary, and the farmer will later on have to contend with the important branch of tobacco-culture technically known as *worming*, which in the past from its slow, irksome, and costly nature, exercised a prejudicial influence against the adoption by Europeans of tobacco as a crop for general cultivation. And from the not unnatural aversion manifested by them to this tedious form of labour, the industry has became as a result largely identified with the Chinese, which limitation, however, with the removal of its conducing causes, will, I trust, be dispelled. It can now be satisfactorily demonstrated that with the aid of a knapsack spraying-machine, and without posing or stooping in uncomfortable attitudes as formerly, one man can destroy more insects, &c., in three hours than ten men could do previously in the same period, and instead of the vigorous and repeated examination of the fields every third day or oftener, requisite under the old style of *worming*, a couple of sprayings at intervals of two or three weeks will prove amply sufficient to protect the crop from most forms of insect damage for the period of its growth. This fact should go some way in popularising its cultivation. I will take this opportunity of suggesting that a spraying-machine of the "Vermorel," or similar type, appears to me to be as necesary a part of the equipment of the general farmer as his plough. Each man's holding should, and generally does, consist of a combined garden, orchard, and farm, much of the various vegetation of which have scores of insect and other enemies that can do incalculable damage, and which can only be effectively and economically suppressed by such means as recommended. Hand labour of even the cheapest description is costly, and to a large extent ineffective in keeping down these pests where they abound, which is generally upon the richest soils and most succulent vegetation, entailing proportionately extensive loss which the prompt and judicious use of the spray pump with its various antidotes can alone thoroughly prevent.

In the case of such a crop as tobacco, whose commercial value so largely depends upon the perfect condition of the leaves, it will be evident that a system which not only protects these, but does so at a tithe of the cost of time and labour formerly employed, should require no further recommendation. But, when the same implement is of such general and varied utility on every farmer's homestead, the private or joint ownership of one should be considered a necessity. Its use will certainly reduce the cost of raising tobacco, as well as make the occupation more pleasant, and I will, therefore, consider its general adoption for the purposes of this industry as merely a matter of time. Although other homely preparations, such as extract of gum leaves, or an infusion of old tobacco stalks and damaged leaves with carbonate of soda, may prove efficient, Paris Green is the insecticide to be chiefly commended for use on tobacco plants, and the following notes extracted from Mr. A. H. Benson's valuable pamphlet on "Insect and Fungoid Pests," issued gratuitously by this Department, give full particulars of its character, methods of application, and effects :—

The use of Paris Green as an Insecticide.

Paris Green, properly applied, is one of the cheapest and most efficacious insecticides for the destruction of all insects feeding either on the leaves or skin of fruit, or on the leaves or stems of such plants as cucumbers, pumpkins, melons, potatoes, tomatoes cabbages, corn, tobacco, &c., though owing to its extremely poisonous properties it

requires great care and judgment in its use, handling, and application—especial care being taken to keep it out of the way of children or careless people.

Paris Green is an arsenite of copper, and, as a rule, it does not vary greatly in strength, which is of great importance in the use of arsenites, as it is necessary to know the exact strength of the mixture being used. If used too strong it is apt to injure the foliage and do more harm than good. Variation in strength is a great drawback to the use of London Purple, another arsenical poison recommended as an insecticide, but being a by-product it is found to vary considerably, hardly any two samples being alike.

Paris Green is in the form of a very fine powder which is insoluble in water, with which, however, it mixes readily and remains in suspension if the mixture is kept well stirred.

The best way to mix Paris Green with water is to place the amount required in a cup or billy with a little cold water, and thoroughly moisten every particle—the same way as mustard is mixed up for table use—and then add more water gradually, stirring all the time till it is thoroughly incorporated, when it is added to the requisite quantity of water, stirring well whilst doing so. Paris Green is most effectually and economically applied by means of a spray pump, which should be fitted with an agitator so that the mixture is kept thoroughly stirred whilst in use. If the pump has no such attachment it will be necessary to stir by hand, otherwise the bottom portion of the mixture will be much too strong and do considerable damage to the fruit or foliage. Any good spray pump will do good work provided it is fitted with suitable nozzles, such as the triple cyclone, or Vermorel, the object being to distribute the mixture over every portion of the tree or plant in the form of the finest possible spray, which should resemble a thick Scotch mist as nearly as possible. The reason that it is advisable to apply Paris Green in the form of such a fine spray is that by this means every portion of the tree or plant is covered, and the poison itself being in such a very fine state of division every little particle of spray contains a minute trace of it, and the poison is thus very evenly distributed.

Paris Green does not kill insects by actual contact as is the case when kerosene emulsion, resin, or caustic washes are used, but it must be eaten by the insect. The slightest trace proves fatal, and as it is so completely distributed over the tree or plant, if the insect eats any portion of either the leaves, skin of the fruit, or stem, it is at once killed.

In the application of Paris Green the following rules must always be carefully attended to, or it may result in damage either to the tree or plant sprayed, or to the person or persons using the spray:—

1. It must be thoroughly mixed with the water.
2. The mixture must be kept thoroughly stirred.
3. A uniform strength of not more than 1 oz. to 10 gallons of water must be used; this is equivalent to 1 lb. to 160 gallons of water, instead of 1 lb. to 130 gallons, as previously advised. Anything stronger than 1 lb. to 160 gallons is not advisable, as it will either destroy the foliage wholly or in part, and this strength is sufficient to kill any insect.
4. Never spray trees or plants when in blossom, as, in addition to destroying most of the fruit, it will destroy large numbers of bees and other insects which are of great value for fertilising purposes.
5. Never spray when there is a burning sun or a strong drying wind. The best time to spray is either on a dull day or in the afternoon, towards evening.
6. Never spray within a month of the time of using either the fruit or vegetables sprayed, or there may be possible danger to persons eating them. A month after application there is not the slightest danger, many careful chemical tests having failed to find a trace of it remaining then.
7. Be careful not to have any wounds or sores on the hands when spraying; if so, wear gloves.
8. Never stand in the spray and so inhale it, and always take care that the spray blows away from the man spraying.
9. Keep the poison under lock and key and out of the way of children.

Paris Green is generally used by itself, but if desired it can be used with lime, in the proportion of 1 lb. of Paris Green to 4 lb. of lime, taking care that the lime is in the finest possible state. Mixing it with lime tends to make it less dangerous to handle, and will not interfere in any way with its action. Of course the same care must be taken in mixing and in keeping the mixture thoroughly stirred, as is advised when the Paris Green is used alone.

Paris Green can be purchased from any of the wholesale drug stores in Sydney at 1s. 3d. per lb. or 28s. per quarter (28 lb.)

Where for any reason sprays cannot be applied I know of no other means of thoroughly eradicating insects from a tobacco field except that of personally collecting and destroying them, at which and similar light work to be subsequently described children may be profitably employed.

Moths should be destroyed whenever practicable, for which purpose lamp-traps are sometimes successfully used. The most prevalent and objectionable are a small variety of moth, whose larvæ are of a pale green colour, with a ravenous appetite, may be found on either the top or under side of the leaves, from the centre of which they devour large irregular patches, in contradistinction to grasshoppers, crickets, and a few tobacco-eating beetles, who feed chiefly from the margin. The potato moth (*lita solanella*) is another, and, as far as my experience has gone, the worst insect enemy which the tobacco plant has to contend with in this country. Its grubs commence their depredations, if opportunity serves, in the seed-bed, and successive generations of them continue this work during the life of the plant in the field, and afterwards in the tobacco shed, in either of which positions they are almost impossible of detection except by their ravages. This moth lays its eggs on the under side of the leaves, and the larvæ when hatched, although small, are armed with formidable jaws, with which they immediately bore into the midrib or lateral veins emerging soon afterwards between the upper and lower cuticle of the leaf, the tissues of which they completely devour, as is evident from the transparency of their recent home. After feeding to maturity the larva descends into the earth, whence it subsequently emerges to enter upon a similar destructive career as that of its disreputable parent. Where potatoes and tobacco are grown in proximity or in alternation the liability to injury from these insects is greatest. On a Chinaman's cultivation at Hilla's Creek last season, where the former conditions existed, 9 acres of tobacco were absolutely destroyed by this caterpillar, which were present in numbers upon each plant, and every part thereof above ground, stalk, ribs, and leaves, with the above result. The unusual extent of this catastrophe led to my making inquiries, which showed that the ground had for successive years been under the same class of crops, and that it had never received any winter ploughings that might expose and destroy the chrysalis. Spraying with an insecticide seems a probable remedy for this widespread pest. Several kinds of insects feeding on this plant hide in the ground during the day, and may be detected and destroyed from the surface signs of their burrows, which are generally close to the stem. They are mostly night-feeders, a notable exception being the common ground beetle (*Gryllus servellei*), who, however, is only destructive to the young plants. Meal or bran mixed with syrup and arsenic strewn near their haunts is an application in general use for their suppression, but which would be impracticable where the invaluable aid of poultry may be called in to rid the tobacco field of the above undesirable visitors. Where a field may be exposed to a grasshopper or similar plague deep furrows should be run with a plough all round. This plan has proved successful on many occasions.

As it is the object of the farmer to raise a crop of whole sound leaves and not broken or perforated ones, no necessary care and attention due in its further cultivation for the attainment of this end should be omitted, therefore worming in whatever fashion it may be carried out should be thoroughly and well done, as an insect or worm damaged crop is of very little value in our home market and of none at all outside of it.

The area which one man could "worm" has in the past largely determined the limit of cultivation possible by him, so it will be seen that by the adoption of sprays, and the consequent minimising of labour, a single individual's

capacity for such work is greatly enhanced, and when to this economy is added the saving use of horse implements in the further field work, I think it quite feasible for one man to plant, tend, and harvest 3 acres of tobacco, which statement will furnish the reader with a fair basis for calculating the probable merits of tobacco as a crop.

Cultivation.

In land of good natural texture and friability there is not much tendency to cake, and very little cultivation serves to keep it in good condition, but many soils through poverty of organic matter, bad drainage, or excess of undissolved (integrate) clay will cake after absorption of even a small quantity of surface moisture. This condition is bad for the growth of any crop, as the surface crust not only excludes the air, but being a bad conductor, the heat also, so that the ground near the roots is chilled and growth restricted. Consequently where there is a liability to this formation it should be prevented by taking a one-horse cultivator or scarifier between the rows and again transversely, as frequently as may be found necessary during the season. Care must be taken that neither the leaves nor roots of the plants are damaged in this operation, which, apart from other favourable results, renders land and crops so treated less susceptible to the influence of prolonged droughts, as the unimpeded action of sun and air draw what moisture may exist in the ground towards the surface.

Contributions to an Economic Knowledge of Australian Rusts (*Uredinidæ*).

BY N. A. COBB,
Department of Agriculture.

CHAPTER VI.

Varieties of Wheat.

WE proceed next to describe about ninety wheats, which are either already in general cultivation in this country, or are worthy for one reason or another of our notice. These descriptions are original, and are taken from specimens grown in New South Wales.

Particular attention is called to the figures on this page and the page following, which are so drawn as to show exactly what we mean by certain terms used in the descriptions, about which there might be liability to mistake, or at least uncertainty, if they were not carefully defined. It may be well to state that when, in speaking of an ear of wheat, we say it is *bald*, we mean not bearded; when we say *smooth*, we mean not velvety; when we say *regular*, we mean having its various parts arranged in an orderly manner; when we say *square*, we mean that when the ear is looked at endwise, its

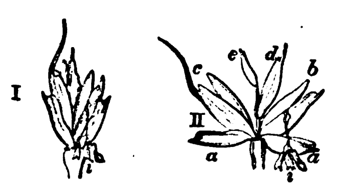


Fig. 45.—I. One of the spikelets of an ear of wheat. II. The same spikelet opened to show the parts; *a*, the outer chaff or glumes; *b*, *c*, two pairs of the inner chaff or palets (both *b* and *c* enclose a grain when ripe); *d*, *e*, two further pairs of the inner chaff, which often fail to grow grain; *i*, the three stamens issuing from *b*. The spikelet was drawn at the time of flowering.

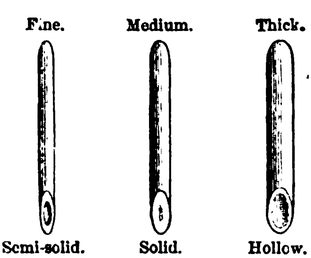


Fig. 46.—Three pieces of wheaten straw, natural size, to show what is meant by the terms fine, medium, coarse, and solid, semi-solid, and hollow.

two diameters appear of equal length; otherwise, of course, it is flattened, and we say *obversely* flattened when the long diameter, or width, is in the direction in which the spikelets are spread out; when we say *glaucous*, we mean having a bloom like that on grapes or plums; when we say *mucronate*, we mean having a spur or prod at the tip. We speak of the crease of the

grain as deep when it cuts two-thirds the way through, and shallow when it passes only half-way through, measuring always from a line that would graze both bosoms.

It is very desirable that wheat-growers, millers, and seedsmen should be careful in their use of names of wheat, and we hope that these descriptions will be

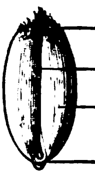


Fig. 47.—A grain of wheat, front view, three times natural size, to show the different parts.

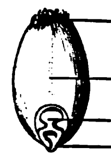


Fig. 48.—A grain of wheat, back view, three times natural size, to show the different parts.

an aid in the direction of greater accuracy in this respect. As a matter of fact, the names of wheat are used very loosely at present, what is known, for instance, as Talavera in one district being different from that known as Talavera in another district, and the great carelessness that

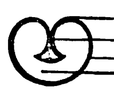


Fig. 49.—Section through a grain of wheat, three times enlarged, to show the different parts.

Fig. 50.—Sections through three grains of wheat, to show what is meant by the terms angular-bosomed, flat-bosomed, plump-bosomed, close crease, and open crease.

prevails is shown by the fact that neither district is right. We could go on multiplying such instances almost indefinitely, but we content ourselves with saying that the state of things we have discovered is not creditable, and that we introduce these descriptions here at the cost of much trouble in order that some sort of a standard may be available to farmers, and in order that it may be known exactly what we mean in later chapters when we refer to certain wheats by name.

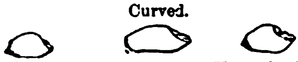


Fig. 51.—Three side views of grains of wheat, to show what is meant by a long, a short, a curved, and a hump-backed grain.

We wish it clearly understood that when we refer to the milling quality of a wheat we do not pretend to express original opinions, but such as come to us from those we believe qualified to give information on this point.

Our illustrations are taken from well-grown ears of each variety, and are reduced to one-third the size of the original ear. *The lower part of each is cut off and turned* so as to show the manner in which the spikelets spread out. The grains are shown natural size in each case, and the top view is of a cross-section cut from the grain near the middle.

TABULAR ARRANGEMENT OF THE WHEATS DESCRIBED.

						No.
Fine Wheats (*Triticum sativum*).	Bald, *i.e.*, beardless.	Ear, white or yellowish.	Ear, smooth, *i.e.*, not velvety.	Grain, white or yellowish.	Thomas' Rust-resistant	1
					Smith's Nonpareil	2
					Blount's Lambrigg	3
					Chili	4
					Little Club	5
					White Lammas	6
					Dallas	7
					Berthoud	8
					White Essex	9
					Bellevue Talavera	10
					Australian Talavera	11
					High Grade	12
					Oakshott's Champion	13
					Frampton	14
					White Naples	15
					Early Para	16
					King's Jubilee	17
					Improved Fife	18
				Grain, red or amber.	Fultz	19
					Saskatchewan Fife	20
					White Fife	21
					Leak's	22
					Battlefield	23
					Cape	24
					Pringle's Defiance	25
			Ear, velvety		White Velvet	26
		Ear, rosy		Grain, white or yellowish.	Hudson's Early Purple Straw	27
					Steer's Early Purple Straw	28
					Farmer's Friend	29
					Fillbag	30
					Rattling Tom	31
					Red Straw	32
					Northern Champion	33
					Steinwedel	34
					Jacinth	35
					Golden Drop	36
					The Blount	37
					Rattling Jack	38
					Fort Collins	39
					Frame's Early	40
					Fountain	41
					White Tuscan	42
					Agate	43
				Grain, ruddy	Red Tuscan	44
		Ear, red or brown.	Ear, smooth, *i.e.*, not velvety.	Grain, white or yellowish.	Ward's Prolific	45
					Clawson	46
					Allora Spring	47
					California Spring	48
				Grain, red or amber.	Red Provence	49
					Robin's Rust-resistant	50
					Sicilian Square-headed Red	51
			Ear, velvety		Velvet Pearl	52
	Bearded.	Ear, white or yellowish		Grain, white or yellowish.	Canning Downs Rust-resistant	53
				Grain, red or amber.	Early Baart	54
					Barbu à gros grain	55
					Moscow	56
					Lazistan	57
					Darblay's Hungarian	58
					Cythere White	59
		Ear, rosy			French Early Bearded	60
					Anglo-Australian	61
					Bearded Herisson	62
		Ear, red or brown			Rieti	63
					Early Japanese	64
Poulard Wheats (*Triticum turgidum*)					Miracle or Mummy	65
					Smooth White Poulard	66
					Galland's Hybrid	67
Flinty Wheats (*Triticum durum*).		Ear, brown			Medeah	68
					Belotourka	69
		Ear, white			Xeres	70
Polish Wheat (*Triticum polonicum*)					Poland	71

1. **Thomas' Rust-resistant.**—Of medium height. The dull yellow straw is furrowed, hollow, of medium thickness, stiff, tapering, strong. The smooth yellow ears are bald, of medium length, regular, compact, of uniform diameter throughout the length, flattened obversely, erect, straight, rather blunt at the tip, tapering at the base, where there are three or four sterile spikelets. There are three grains in each of the fertile spikelets. The chaff is short, dull in lustre and uniform in colour, blunt at the base of the ear but short-awned toward the tip, rather soft, rather shallow, round-backed, firmly attached, and lies close to the grain, in spite of which fact, however, some shelling occurs. The grain is small, short, straight, plump, opaque, yellowish, rather plump-bosomed, blunt at both ends, and has a rather shallow crease, a mealy cross-section, and an abundant brush. A back-crease is sometimes visible. The germ-sculpture is two-fifths as long as the grain.


Fig. 52.—Thomas' Rust-resistant.

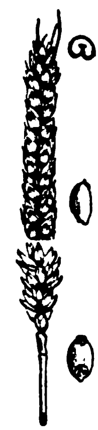
This variety is apparently hardy, and it is certainly fairly prolific; it ripens in mid-season, and must be sown early. It is said to be resistant to rust.

2. **Smith's Nonpareil.**—A good reputation attaches to this wheat, and deservedly. It has many good qualities, not the least of which is its power to resist rust. It is of medium height, and possesses a strong though rather hollow straw of medium and rather uniform size, not very stiff but fairly tough, and of a dull-yellow colour. When ripening the straw is green, never purple. The foliage is not very abundant, the flags being rather narrow, inclined to droop, of a deep-green colour, and somewhat glaucous. The heads are bald, yellow, smooth—that is, not velvety—of medium length, regular, compact, tapering but little, square, erect, straight, acute at the tip, rather abrupt at the base, where there are three to five sterile spikelets. Though the spikelets are three-grained, they spread but little. The chaff is long, the outer being rather acute and mucronate, the tips being bent slightly inwards, and the inner short-awned towards the top of the ear, where two or three long awns appear. On the whole the chaff is rather thin and soft; it is dull and uniform in colour, shallow, round-backed, pretty firmly-attached, and hugs the grain closely. Though the grain is only of medium size and length, it is rather plump; it is straight, opaque, yellowish, flat-bosomed, blunt at the tip, rather blunt at the base, and has an abundant brush, a deep crease, and a large germ-sculpture two-fifths as long as the grain. The back-crease is often quite marked. The grain is mealy inside.

Smith's Nonpareil is a fairly prolific, hardy, rust-resistant wheat of medium earliness, resembling the Fifes in appearance,—a wheat that will stand a lot of careless farming and yet stool well and yield something. It may be sown late and yet come to maturity fairly well. The grain is of good milling quality, and will fetch a good price when fairly well grown. It is now grown in a number of districts in New South Wales, and is generally liked.

3. **Blount's Lambrigg.**—This is a strong-stooling wheat of medium height, or even rather tall, yielding well under proper treatment. The straw is strong, tough, stiff, hollow, of medium thickness, slightly tapering, and of medium flexibility. The sheath is long, reaching half-way to the base of the ear. The joints are not prominent. The foliage is of medium abundance. The flag is erect, smooth, dark green, glaucous and tough, rather narrow,

and of medium length. The bald, square, erect, regular heads are smooth and yellow; of medium length and compactness, uniform in diameter or clubbed at the tip, often twisted, blunt at the tip, tapering at the base, where they present from three to four sterile spikelets. The fertile spikelets are spreading and three-grained. The chaff is of a dull uniform colour, somewhat angular-backed, deep, close-lying; firmly attached, stiff and short, nearly acute, mucronate at the base of the ear and short-awned at tip. The grain is rather small and flat, of medium length, straight, plump, opaque or horny, flat-bosomed, of a yellowish or amber colour, rather pointed at the base, blunt at the tip, and presents a small brush. The crease is deep, and a back-crease is also visible. When cut the section appears horny or mealy. The germ-sculpture is large.



53.—Blount's Lambrigg.

The Australian Blount's Lambrigg originated with Mr. Wm. Farrar in the Queanbeyan district, from seed imported from America. It has found favour in many parts of the country, and more and more of it is grown from year to year. It has a marked power to resist rust, and is to be highly recommended [illegible] at account. The grain is of fair milling quality, and brings a good price. This variety will not do well on naturally wet land, nor in a very wet season, except the drainage be good. It is a late wheat, and must be sown early. It is not suitable for coast districts. The Fife wheats seem to be those to which Blount's Lambrigg is related, and one may hazard the guess that it resulted from the crossing of a Fife and a different and fuller-headed sort.

4. **Chili; Oregon Club.**—There are several varieties agreeing essentially one with another grown under these names in the United States. Although they have been introduced into European countries they have not there come into favour, one reason being the poor yield of straw, which in Europe is a valuable product. This factor would not be so important in this country, and these sorts may, therefore, yet find a place among our cereals. At present they are not in use. The specimens from which the present description is drawn are tall and have heads of medium length. The straw is yellow, dull in lustre, coarsely furrowed, very hollow, of medium thickness, stiff, and rather brittle. The smooth, yellow, straight, erect heads are bald, of medium length or rather short, very regular, compact or even crowded at the tip, clubbed, flat, blunt at both ends, and present four or five sterile spikelets at the base. The spreading fertile spikelets contain three grains each. The chaff is of medium length, acute, with bent mucrons, short-awned towards the tip of the ear, rather stiff, dull in lustre and uniform in colour, deep, almost angular-backed, firmly attached, and lies close enough to the grain to prevent much shelling. The grain is of medium size and length, straight, almost hump-backed, plump, opaque, yellowish, plump-bosomed, blunt at the tip, rather blunt at the base, and has an abundant

Fig. 54.—Chili.

brush, a rather deep crease, and a mealy cross-section. A back-crease is rarely visible. The germ-sculpture is one-third as long as the grain.

This is a prolific mid-season variety, subject to rust, and one that must be sown early. There are short-eared and long-eared strains of this variety.

5. **Little Club.**—Wheats of this type are known and cultivated in most wheat-growing countries. They are below the medium height, and have small but exceedingly compact flat heads containing a surprising amount of grain, considering their size. They do not yield much straw. The straw of Little Club is yellow, of a dull lustre, coarsely furrowed, hollow, of medium thickness, stiff and strong. The smooth, bald, yellow ears are very short, fairly regular, crowded, clubbed, much flattened, erect and rigid, straight, blunt at the tip, rather abrupt at the base, where there are one or two sterile spikelets. There are four grains in most of the spikelets, which are spread out well. The chaff is short, incurved-mucronate, short-awned at the tip of the ear, stiff, rather shiny, uniform in colour, rather shallow, round-backed, firmly attached, and lies close to the grain. Shelling is prevented by the close packing of the spikelets, in fact, this wheat is rather difficult to thresh on that account. The grain is of medium size, of medium length, a little oblique, somewhat hump-backed, plump, opaque, yellowish, rather angular-bosomed, blunt at the tip but tapering in that direction, pointed at the base, and has a small brush, a shallow open crease, and a mealy interior. A back-crease is visible. The germ-sculpture is one-third to two-fifths as long as the grain.

Fig. 55.—Smooth Herisson.

Little Club is a hardy and fairly prolific mid-season wheat. We do not consider it resistant to rust. Hedgerow and Smooth Herisson varieties are very similar to Little Club, but the ears are smaller, not clubbed, and contain smaller grains more distorted by the close packing.

6. **White Lammas.**—Tall, with strong whitish straw of medium size. The ears are smooth, bald, long, very regular, somewhat open, tapering, square, erect or leaning, a trifle curved, acute at the tip, abrupt at the base, where there are two or three sterile spikelets, whitish, with the tips of the chaff almost salmon-coloured. The spikelets are narrow, and contain two grains. The chaff is shiny, streaked with colour at the tip, of medium length, blunt, very short-awned towards the tip of the ear, rather stiff and thick, rather deep, round-backed, firmly attached, and lies pretty close to the grain. There is little or no shelling. The grain is large, long, straight, plump, opaque, yellowish, rather plump-bosomed, quite blunt at both ends, and has a long and abundant brush, a deep crease and a mealy cross-section. No back crease is visible. The germ-sculpture is two-fifths as long as the grain.

Fig. 56—Noé.

This handsome, freely-stooling, prolific, hardy, mid-season wheat is well known and deservedly popular. It is hardly resistant to rust, but yields grain of very good quality indeed. It is suitable to any but the coast districts. It varies considerably in form, but is easy to recognise. It seems to me very likely that the White Lammas is similar to the popular wheat known in France under the name of Noé or

Blue Wheat, the latter name being applied on account of the glaucousness of the stools up to the time of flowering. The grain of Noé is more ruddy; in most other respects however, the resemblance is striking. A wheat we have observed under the name of Scotch Wonder also resembles the White Lammas, but is taller and more slender in all parts, even the grain being proportionally narrower though equally blunt at both ends.

7. **Dallas.**—Rather tall. The straw is dull in lustre, yellow, at no time purple, of medium thickness, hollow, stiff, and strong. The sheath of the topmost leaf reaches only two-fifths the way up to the ear. The smooth, whitish, straight, erect, and regular ears are bald, long, slightly open, tapering, square, acute at the tip, tapering at the base, where there are from two to four sterile spikelets. The fertile spikelets are narrow, and contain two grains. The chaff is almost shiny, of uniform colour, rather long, blunt near the base of the ear, but acute and short-awned at the tip of the ear, very stiff, shallow, almost angular-backed, firmly attached, and hugs the grain closely. The grain is large, long, straight, of medium plumpness, opaque, yellowish, rather plump-bosomed, blunt at the tip, rather pointed at the base, and has an abundant brush, and a rather shallow open crease; a back-crease is very rarely visible. When cut in two the grain is seen to be rather mealy inside. The germ-sculpture is one-third to two-fifths as long as the grain.

Dallas stools well, is prolific, and yields very handsome grain of uniform and large size and excellent quality. It is possible that this variety is identical with White Lammas.

8. **Berthoud.**—This is one of the most graceful and attractive of the beardless wheats. One could not wish to see a braver sight than these beautifully tinted heavily laden heads fairly leaning over with the weight of their grain, bobbing and waving on the slightest provocation. The Berthoud is of medium height, and has a strong though flexible and hollow straw of medium thickness and of rather uniform diameter—that is, not tapering much. Before ripening, the straw is green, but when ripe it is of a dull yellow colour. The ears are long, regular, open, very tapering, square, curved and leaning over when ripe, acute at the tip, tapering at the base, where there are from three to six sterile spikelets. In colour the ears are yellow with dashes of faint pink, brown, or purple. The spikelets are rather narrow, and only two-grained. The chaff is peculiar, being of medium length, with blunt hooked points, which change to short awns near the tip of the ear. There is scarcely any other wheat that presents this peculiarity. As for the rest, the chaff is quite thick and stiff, not shiny, angular-backed, shallow, streaked with colour, lies close upon the grain, but is a trifle loosely attached, and this allows it to shell a very little. The grain is long, plump, and beautiful, and very large; it is of an opaque yellowish colour, flat-bosomed, blunt at both ends, with a deep close crease and very large germ-sculpture; no back-crease is visible. In section the grain is rather horny. The grain has every appearance of being of very good milling quality.

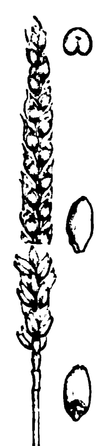


Fig. 57.—Berthoud.

This is plainly a hardy sort of wheat, and with the right treatment fairly prolific. It does not stool very freely, but this can be compensated for by an extra quantity of seed per acre, say a fourth to a third more than for

most sorts, this being all the more necessary as the seed is usually very large. It has not been under our observation very long, but we believe it is somewhat resistant to rust. This wheat is not early, nor yet late. It should be sown early. It will do well on land which is not of the best character. It does well in the Tamworth, Corowa, and Queanbeyan districts, and would, no doubt, do well in other districts. We cannot yet speak with great confidence, but we believe this may be a very good wheat. It is well worth a trial. The Berthoud has an unmistakable resemblance to the White Lammas, but the ears taper more and are more curved when ripe; it also stools less freely.

9. **White Essex.**—Rather tall, with good stools; straw strong, of medium thickness, stiff, fairly tough, hollow, tapering but little, dull in colour, distinctly furrowed, yellow, at no time purple. The heads are whitish, bald—that is, not bearded—long, regular, open, tapering, square, erect, nearly straight, acute at the tip, tapering at the base, where there are two or three sterile spikelets. The narrow spikelets contain only two grains, but, as usual where this is the case, both are large. The chaff is of medium length, blunt near the base of the ear, acute towards the tip of the ear, and even short-awned at the end; it is very stiff, almost shiny, sub-angular backed, shallow, nearly uniform in colour, is firmly attached, and hugs the grain closely. The grain is large, long, straight, of medium plumpness, horny, yellowish, rather flat-bosomed, blunt at the tip, rather blunt at the base, and has a fairly deep crease and a small brush. The germ-sculpture is two-fifths as long as the grain, and is more dorsal than usual. The interior of the grain is horny. No back-crease is visible.


Fig. 58.—White Essex.

White Essex yields fairly well and gives beautiful grain of excellent milling quality. It is grown extensively in some parts of this country.

10. **Talavera de Bellevue.**—A wheat of Spanish origin, of medium height and excellent quality. The whitish, furrowed straw, is thick, stiff, strong, rather hollow, rather shiny, and tapers but little. At no stage of its growth is the straw purple; the joints are rather prominent. The smooth yellowish ears are bald, long, regular, very open, of rather uniform thickness throughout the length, flattened obversely, erect, stiff, straight or slightly curved, hardly acute at the tip, tapering at the base, where there are one or two sterile spikelets. The narrow fertile spikelets are two (or three) grained. The shallow, stiff, and shiny chaff is of uniform colour, long, blunt, except near the tip of the ear where it has sharp and stiff short awns, is firmly attached, angular backed, and lies close upon the grain so that shelling never occurs. The grain is large, long, straight, of medium plumpness, horny, light amber-coloured, flat-bosomed, blunt at the base, and has a medium sized brush, a very deep close crease, and a germ-sculpture extending one-fourth its length. A back-crease is barely visible. On being cut with a knife the interior of the grain appears rather horny.

The Bellevue Talavera is a prolific, hardy, midseason sort, having a grain of extra good quality. It is not now grown to any extent in this country, but is deserving of introduction, and will no doubt suit warm dry districts admirably. It resembles the Australian Talavera, but the ear is more open, and has narrower spikelets with stiffer and more shiny chaff, and shorter awns.

11. Australian Talavera.—Whether this is a strain of the Bellevue Talavera is uncertain; the resemblance at any rate is unmistakable. Like the Bellevue this present variety is of medium height. The dull-yellow, furrowed straw is of medium thickness, almost semi-solid, stiff, strong, and tapers little; at no period of growth is it purple. The ears are smooth, whitish, bald, long, regular, very open, markedly tapering, square, erect or leaning a little, nearly straight, acute at the tip, tapering at the base, where there are one or two sterile spikelets. The fertile spikelets are narrow and two-grained. The chaff is dull and uniform in colour, long, blunt, mucronate near the base of the ear, acute at the middle of the ear, and short-awned towards the top of the ear, very thick and stiff, deep, angular-backed, close-lying, but loosely attached, so that a little shelling is likely to occur. The grain is large, long, straight, of medium plumpness, opaque, yellowish, flat-bosomed or almost angular-bosomed, blunt at the tip, rather pointed at the base, and has an abundant brush, a moderately deep crease, and often a faint back-crease. The interior of the grain is rather horny. The germ-sculpture is one-third as long as the grain.

Fig. 59.—Australian Talavera

Like the Talavera de Bellevue, the Australian Talavera is a hardy mid-season wheat which stools well and yields well, and is somewhat resistant to rust. It is prolific, and its grain is of exceptionally good quality. It is grown to considerable extent in Australia, although much of the wheat grown under the name of Talavera, White Talavera, &c., is not Talavera at all, but totally different.

12. High Grade.—Rather tall, and stools well. The straw is rather shiny, yellow, at no time purple, furrowed, very hollow, stout, strong, stiff. The sheath of the uppermost leaf extends more than half way to the ear. The smooth, whitish heads are bald, long, regular, a trifle open, a little tapering near the summit, square, erect, straight, acute at the tip, abrupt at the base, where there are three or four sterile spikelets. There are three grains in the wide-spread fertile spikelets. The chaff is rather shiny, uniform in colour, of medium length, bluntly incurved-mucronate towards the base of the ear, and very short awned towards the top, a trifle soft, shallow, round-backed, firmly attached, but not lying very close to the grain. Little, if any, shelling occurs. The grain is above medium size and length, straight, plump, opaque, yellowish, rather plump-bosomed, blunt at both ends, and has a rather abundant brush, a deep but open crease, and a mealy interior. A back-crease is faintly visible. The germ-sculpture is one-third as long as the grain.

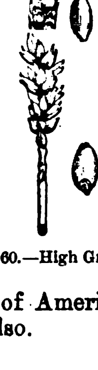


Fig. 60.—High Grade.

High Grade is a prolific wheat, in favour in some parts of America. It deserves the attention of farmers in this part of the world also.

13. **Oakshott's Champion.**—Rather tall; the straw is dull in lustre, yellow, at no time purple, furrowed, very hollow, rather thick, strong, and stiff. The sheath of the topmost leaf reaches rather more than half way to the ear. The yellowish or almost rosy, smooth, straight, erect, and regular ears are bald, long, a trifle open, tapering at the tip only, square, acute at the tip, tapering at the base, where there are from two to four sterile spikelets. There are three grains in the rather narrow fertile spikelets. The chaff is dull in lustre, uniform in colour, long, bluntly mucronate with incurved tips toward the base of the ear, short awned towards the top, and at the tip presents one or two long awns; for the rest, it is stiff, deep, round-backed, firmly attached, and lies close to the grain, so that shelling does not occur. The grain is rather large, long, straight, of medium plumpness, opaque, yellowish, flat-bosomed, blunt at the tip, pointed at the base, and has a deep and rather close crease, a mealy cross-section, and an abundant brush. A back-crease is rarely visible. The germ-sculpture is somewhat less than one-third as long as the grain itself.

This is a productive mid-season wheat, having many good qualities, not the least of which is its excellent grain. It is new to this Colony, but has been grown for some years in Victoria.

14. **Frampton.**—The straw of this wheat is yellow in colour, rather shiny, of medium height, thickness, and flexibility; it is hollow, uniform in diameter, and furrowed. The stalk when ripening is purple. The smooth, straight, erect, compact, yellow heads are of medium length, acute at the tip, tapering at the base, and possess four to six sterile spikelets at the bottom. The fertile spikelets are spreading and three-grained. The chaff is pretty firmly attached, bluntly mucronate, close-lying, somewhat angular-backed, short-awned at the tips of the ears, rather shallow, dull and uniform in colour. The grain is large, yellow, opaque, rather plump bosomed, of medium length and plumpness, blunt at the tip, pointed at the base, and possesses an abundant brush and a close deep crease. The back crease is usually, though not always, visible.

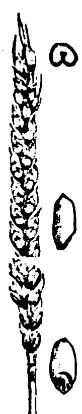


Fig. 61.—Frampton.

Frampton is a mid-season wheat, which stools well and yields a plentiful harvest of grain of first-class milling quality. It is not yet grown in this Colony, but deserves a trial. It is well known in South Australia and Victoria.

15. **White Naples.**—This is a variety not yet grown by Australian farmers, but one that is recommended to them for trial. Though it is not the most prolific of wheats its grain is almost perfection. It stools well, is of medium height, and has an almost semi-solid straw possessing all possible good qualities in a medium degree. When ripe the straw is of a whitish yellow colour; it is never purple. The sheath of the upper leaf is rather short—less than half as long as the distance from the upper joint to the ear. This latter is whitish, bald—that is, not bearded—of medium length, regular, compact, tapering at the top, square, erect, straight, acute at the tip, abrupt at the base, where there are four or five sterile spikelets. The fertile spikelets are somewhat spread out, and contain two or three rather large grains. The rather blunt smooth chaff is of medium length, and changes so as to become acute or even short-awned at the tip of the ear. It is dull and uni-

form in colour, fairly stiff, shallow, sub-angular on the back, is rather loosely attached, and does not hug the grain closely. These latter qualities, of course, permit of some loss by shelling; but this loss is not great with this variety. The grain is of medium length, straight, of medium plumpness, opaque, yellowish, flat-bosomed, blunt at the tip, pointed at the base, and has a very deep crease, and a large germ sculpture one-third as long as the grain. The interior of the grain is rather horny. No back-crease is discernable.

The White Naples is a first-class milling wheat, yielding a beautiful flour of excellent quality. Its stools well, and is fairly prolific. The seed came to this country from France, and has not yet been introduced to the farmers.

Fig. 62.—White Naples.

Fig. 63.—Early Para

16. **Early Para.**—Its weak straw is the worst fault of this otherwise desirable sort. The stools, when full-grown, are of medium height. The rather smooth and shiny whitish straw is almost semi-solid, of medium stiffness, tapering, rather brittle and weak. The sheath of the upper leaf reaches less than half-way to the ear. The smooth whitish bald heads are of medium length, somewhat irregular, compact, tapering, flattened obversely, erect, straight, acute at the tip, tapering at the base, where they present three or four sterile spikelets. The fertile spikelets are spreading, and contain three grains. The chaff is lustrous, thick, uniform in colour, of medium length, blunt, mucronate near the base of the ear, acute and short awned toward the tip of the ear, stiff, shallow, almost angular-backed, rather firmly attached, but not lying close on the grain. In spite of these latter facts, however, little shelling takes place. The grain is of medium size, of medium length, straight, of medium plumpness, opaque, yellowish, flat-bosomed, blunt at the tip but tapering in that direction, pointed at the base, and has a rather small brush, a moderately deep crease, and a mealy cross-section. A back-crease is sometimes visible. The germ-sculpture is two-fifths as long as the grain.

Early Para is among the earliest of the prolific varieties. It stools well, and its grain is of very good quality. If only by selection the straw could be strengthened, a matter of no great difficulty, we believe, this variety

would eclipse many of the sorts now grown. If sown early, it ripens its grain before the warm moist spells likely to occur in late midsummer. This variety originated, I believe, in South Australia, and for a season or two it was much spoken of as the coming variety, but it soon lost favour on account of the weakness mentioned above. It has been tried in all the Australian colonies. King's Jubilee is one of its parents.

17. **King's Jubilee.**—Stools well, and is above the medium height. The straw is hollow, fine, weak, and brittle, which is a great pity, for most of the other qualities of this variety are highly desirable ones. For the rest, the straw is coarsely furrowed, dull, whitish, and of rather uniform diameter, and bent at the joints. The foliage is abundant, rather dark-green in colour, drooping, not glaucous, hard or scabrous, and very brittle and weak. The smooth, whitish, bald, erect, and straight ears are of medium length, irregular, tapering, square, and have spikelets that barely touch each other, an acute tip, a tapering base, and three or four sterile spikelets at the bottom. The rather narrow fertile spikelets contain three grains. The chaff is uniform in colour, long, acute, long-awned throughout, rather shiny, shallow, angular-backed, firmly attached, and lies close to the grain. The grains are rather large, long, straight, rather thin, opaque, whitish, plump bosomed, blunt at the tip, but tapering in that direction, pointed at the base, and have a rather abundant brush, a shallow open crease, and a large germ-sculpture. A back crease is often visible. The interior of the grain is mealy and white.

Fig. 64.—King's Jubilee.

This is one of the very earliest varieties. It stools well, and yields well on good soil. The structure or composition of its tissues renders all its parts weak and brittle. It is very liable to rust, but if sown early it ripens before much damage is done. This wheat will never give satisfaction except in situations protected from strong winds, and where there are no heavy downpours, as both these agencies cause it to lodge dreadfully. It will also lodge from its own weight on land rich in nitrogen. We believe that by selection this wheat might be improved in respect to its weak straw, and it would then be a very useful variety—one that might possibly do for the warm moist coast districts. We believe King's Jubilee originated in South Australia, some years ago. It has not come into general cultivation.

18. **Improved Fife.**—Below medium height, and, like all Fifes, late. The straw is yellow, at no time purple, dull in lustre, furrowed, of medium thickness, hollow, strong, stiff, and tapers but little. The rather scanty foliage is inclined to be erect, narrow, smooth, dark-green and glaucous. The ears are almost rosy, smooth, bald, of medium length, regular, a trifle open, tapering, flattened obversely, erect, straight, acute at the tip, tapering at the base, where there are three or four sterile spikelets. The spreading fertile spikelets contain three grains. The chaff is of medium length, dull and uniform in colour, bluntly mucronate near the base of the ear, and short-awned above the middle of the ear, rather thin and soft, rather shallow, angular-backed, pretty firmly attached, and lying pretty close to the grain. Little if any shelling occurs. The grain is small or of medium size, of medium length, straight, of medium plumpness, opaque, whitish or yellowish, plump-bosomed, blunt at the tip,

rather pointed at the base, and has a deep crease, a rather mealy cross-section, and an abundant brush. A back-crease is rarely visible. The germ-sculpture is two-fifths as long as the grain.

Improved Fife is a hardy rust-resistant late sort; it stools well, is fairly prolific, and yields a grain of good quality. Where lateness is not an objection, it is worthy of attention. It must be sown early.

19. **Fultz.**—A rather tall free-stooling wheat of the Fife kind, not yet grown to any extent in this country. The straw is whitish-yellow in colour, stiff, strong, of medium height and thickness, rather tough, hollow, furrowed, and of a dull lustre. The stalk when ripening is green—never purple. The sheath of the upper leaf is long, reaching more than halfway to the ear. The heads are yellow, smooth—that is not velvety—rather long, regular, open, tapering, straight, erect, and have from two to three sterile spikelets at base. The fertile spikelets are three-grained and spreading. The chaff is uniform in colour, firmly attached and holding the grain fairly well, deep, close-lying, long, acutish, short-awned towards tip of the ear, stiff, firmly attached, and has a dull appearance. The grain is amber-coloured, of medium size and length, straight, opaque, rather flat-bosomed, and blunt at both ends; it has an abundant brush. A back crease is barely visible.

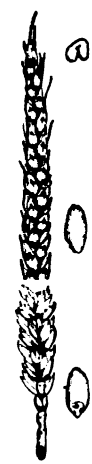


Fig. 65.—Fultz.

Fultz is a well-known variety, somewhat above medium height. The best strains of it are prolific, and yield a grain of good milling quality. It is resistant to rust.

20. **Saskatchewan Fife.**—This is an American strain of the Fife sort. It is rather short even for a Fife. The straw is fine or of medium thickness, stiff, strong, fairly tough, hollow, of rather uniform size, furrowed, dull and whitish in colour, but green when ripening,—never purple. Like all Fife wheats, Saskatchewan has scanty, narrow, tough, glaucous foliage, of a dark green colour, and inclined to be erect. To say that the ears are yellow, bald, *i.e.*, not velvety, of medium length, regular, neither open nor compact, but medium in this respect, tapering, flattened obversely, erect, straight, acute at the tip, and abrupt at the base, and that they present two to four sterile spikelets at the base, is only to say that they are typical Fife ears. The fertile spikelets are well spread and contain three grains. The chaff is short, blunt near the bottom of the ear, short-awned at the middle of the ear, and long-awned at the tip of the ear; it is dull and uniform in colour, stiff, rather shallow, angular-backed, firmly attached, and lies close to the grain, so that little shelling occurs. The grain is rather red, small, short, straight, plump, horny, plump-bosomed, blunt at both ends, and has an abundant brush and a rather deep open crease, and a germ-sculpture two-fifths as long as the grain. A back-crease is visible. The inside of the grain may be either horny or mealy, according to the season and locality where it is grown.

This variety is hardy and resistant to rust, and is a fairly good stooler and yielder. It closely resembles Fultz and White Fife. The seed came to this country from the United States. The name would indicate that it is of Pennsylvanian origin.

21. **White Fife.**—This is one of the best of the Fife wheats. It is a hardy sort, and is said to have a grain rich in gluten—a valuable property. It is a little below the medium height, and has a strong, fine, and somewhat flexible though somewhat hollow straw of nearly uniform diameter. In colour the ripe straw is dull and whitish, never purple. The furrows and joints are rather prominent. The foliage is rather scanty, inclined to be erect or leaning, of medium length, narrow, smooth, rather dark green and glaucous, and, like that of other Fifes, tough. The ears are neither open nor compact, being medium in this respect. They are whitish, smooth—that is, not velvety—beardless, of medium length, regular, tapering, flattened obversely, erect, straight, acute at the tip, and rather abrupt at the base, where there are three or four sterile spikelets. The ears are composed of spreading spikelets containing at least two grains each. The chaff is short, mucronate, blunt near the base of the ear, but acute higher up, short-awned near the middle of the ear, long-awned towards the tip, stiff, dull and uniform in colour, rather shallow, sub-angular-backed, firmly attached and lying close to the grain, and hence preventing much shelling. Though the grain is rather small, it is of medium length, and medium plumpness. It is straight, red or dark amber, horny, plump- or rather angular-bosomed, blunt at both ends, having a small brush and a deep open crease. When cut with a knife the section appears horny. A back-crease is sometimes visible.

Fig. 66.—White Fife.

White Fife resembles Fultz and Saskatchewan, and is resistant to rust, stools well, and is a fair yielder, but, like other Fifes, is rather late and needs to be sown early. Its grain is less acceptable to Australian millers than many other sorts, but such grain finds a ready market in Europe. Similar wheat is grown to a very large extent in the United States and Canada, and the flour made from it is considered to be superior.

22. **Leak's.**—This is a slender-eared wheat, a little above the medium height. It stools well and the straw is stiff and thick, though very hollow and somewhat brittle; it is of a dull yellowish colour, distinctly furrowed, and of rather uniform diameter. The foliage is not very abundant, the flags being rather narrow and inclined to be glaucous, especially when young. The smooth, beardless, long, slender, erect, regular and yellowish ears are tapering, a trifle open, straight, acute at the tip, tapering at the base, where there are two to four sterile spikelets. Although the spikelets are narrow, they contain three grains. The rather shallow, round-backed chaff is blunt in the lower part of the ear, acute elsewhere, short-awned at the tip of the ear, stiff, uniform in colour, rather shiny, and is firmly attached and lies close upon the grain. The grain is of medium size and length, straight, of medium plumpness, horny, amber-coloured, angular-bosomed, blunt at both ends especially at the base, and has a smallish brush, and deep open crease, and a large germ-sculpture. A back-crease is rarely visible. On being cut with a knife, the section is seen to be horny.

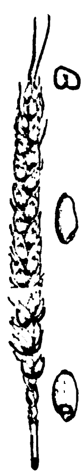


Fig. 67.—Leak's.

Leak's is a hardy and fairly prolific sort, having the form of the Fife wheats, not early nor yet late, yielding a grain of fair milling quality. It resists rust to some extent and is free from shelling, and on these accounts has been cultivated to some extent in several of the Australian colonies. It should be sown early.

23. **Battlefield.**—The straw of this variety is dull yellow, hollow, distinctly furrowed, somewhat brittle, stiff, slightly tapering, and of medium strength and thickness. The stalk when ripening is green, not purple. The sheath of the topmost leaf is long, reaching halfway to the ear. The joints are dark and prominent. The bald, straight, erect, regular heads are of a yellow colour, smooth—that is, not velvety—square, tapering, of medium length and compactness, acute at the tip, tapering at the base, where they present from three to six sterile spikelets. The fertile spikelets are three-grained and spreading. The chaff is dull and uniform in colour, long, deep, rather round-backed, loosely attached, not lying very close upon the grain, rather soft, bluntly mucronate at base of the ear, and long awned towards tips. Considerable shelling occurs. The grain is yellowish or amber-coloured, of medium size, long, straight, angular bosomed, of only medium plumpness, almost horny, pointed at the base, blunt at the tip, and possesses an abundant brush and a very deep open crease. A back-crease is occasionally visible. When cut with a knife the section of the grain appears horny. The germ-sculpture is one-third as long as the grain.

Battlefield originated in South Australia. It has not yet come into general cultivation, in spite of its good qualities.

Fig. 68.—Battlefield.

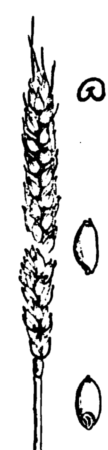


Fig. 69.—Cape.

24. **Cape.**—A rather tall freely-stooling wheat of South African origin. The straw is yellow, at no time purple, of medium thickness, hollow, furrowed, stiff and strong, and tapers but little. The smooth, yellow, straight, erect, regular ears, are bald, of medium length, very slightly open, of uniform size throughout the length, square, acute at the tip but abrupt at the base, where there are one or two sterile spikelets. The fertile spikelets are rather narrow though three-grained. The dull and uniform-coloured chaff is long, blunt, but incurved-mucronate, short-awned at the tip of the ear, stiff, almost angular backed, rather shallow, firmly attached, and hugs the grain

closely, so that shelling almost never occurs. The grain is large, long, straight, of medium plumpness, opaque, very light amber-coloured, almost angular-bosomed, blunt at the tip, rather pointed at the base, and has a brush of medium size, and a deep rather close crease. There is no back-crease. In cross-section the grain appears mealy. The germ-sculpture is one-third as long as the grain itself.

Cape is a prolific mid-season wheat, which is, we think, somewhat resistant to rust. The grain appears to be of good quality. The wheats most nearly resembling Cape are Leaks, Pringle's Defiance, and the Fifes.

25. **Pringle's Defiance.**—The wheat which has been known in Queeesland under the name of Defiance, seems to be identical with this. It is of medium height, and the straw is dull in lustre, whitish, furrowed, hollow, thick, strong, stiff, and tapering. The sheath of the topmost leaf reaches less than half way to the ear. The whitish or yellow, smooth, straight, erect, regular ears, are bald, rather long, or of medium length, compact, tapering, square, acute at the top, abrupt at the base, where there are three to five sterile spikelets. Three grains fill the spreading fertile spikelets. The chaff is dull in lustre, uniform in colour, long, rather acute, short-awned towards the tip, rather thin and a trifle soft, shallow, almost angular-backed, firmly attached, and lie somewhat close to the grain. The compactness of the ear prevents any great amount of shelling. The grain is of medium size and length, straight, of medium plumpness, horny, amber-coloured, rather plump-bosomed, blunt at the tip and also at the base, and has an abundant brush, a rather deep crease, and a horny cross-section. A back-crease is usually visible. The germ-sculpture is two-fifths as long as the grain.

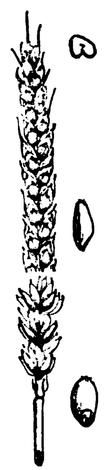


Fig. 70.—Pringle's Defiance.

Pringle's Defiance is a hardy, prolific, mid-season wheat, resistant to rust, and yielding a grain of excellent quality. It stools freely, and thrives, that is, yields some sort of a crop, even on rather poor land and with poor treatment. Wheats answering this description are grown in all the Australian colonies.

26. **White Velvet.**—This handsome variety receives its name from the fact that its chaff is covered with fine hairs, and it is called the *White* Velvet to distinguish it from the red-eared velvety sorts. When ripe the straw as well as the ear is whitish. Being of medium height, it possesses, as one would expect, a fine semi-solid straw of medium strength and flexibility, not, however, remarkably tough. The straw tapers but little and is distinctly furrowed ; at no stage of its growth is it purple. The sheath of the upper leaf is rather short, being only two-fifths as long as the distance from the uppermost joint to the ear. The short, regular, compact ears are beardless, straight, erect, tapering, square, acute at the tip, abrupt at the base, where they present only two or three sterile spikelets. At the tip of the ear the chaff of the spreading three-grained spikelets is acute or even short-awned, but at the base of the ear it is blunt. The chaff is of medium stiffness, dull, round-backed, fairly deep, of uniform colour, firmly attached and lies close upon the grain, so that it is not liable to shell much, a quality that recommends this variety in districts where strippers are in use. The White

Velvet wheat has a beautiful little grain, nearly white, of fine milling quality; it is short, straight, plump, opaque, flat-bosomed, tapering towards the blunt tip, blunt at the base, with an abundant brush and a close deep crease. A back-crease is never visible on grains well filled out. Inside, the grain is snow-white and mealy.

This wheat stools well and is a good yielder, and is said to resist rust, but we are not yet able to corroborate this statement,—in fact doubt it. It is rather early and may escape rust on that account. It stools fairly well, and as the grain is small, it requires less bulk of seed per acre than the larger grained sorts. Our impression is that it does best in limestone country.

27. **Hudson's Early Purple Straw.**—This is a tall beardless, free-stooling wheat, with a strong stiff straw of medium thickness. When ripening the straw becomes first purple and finally yellowish. The ripe straw is dull coloured, and though quite hollow is tough. The foliage is abundant, long and drooping, of a medium green colour and never very glaucous. The numerous large, long, and regular ears are erect, and rather compact, especially at the tip, where they are slightly clubbed and end abrubtly; they are almost equally abrupt at the base, there being seldom more than two sterile spikelets at the bottom. The fertile spikelets are spreading and contain three or four large, long, yellowish grains of medium plumpness. The chaff is nowhere very blunt, and towards the tip of the ear is armed with awns, the very topmost spikelet bearing awns of considerable length. In colour the chaff is uniform and dull; it is smooth—that is, not velvety—deep and round-backed, and is firmly attached and lies very close upon the grain, thus giving this variety the property of holding the grain very well and so allowing the use of any sort of harvesting machinery without much loss. The grain threshes out easily and will fetch the highest price, being of first-class milling quality. It is opaque, of a yellowish colour, plump-bosomed, blunt at both ends and has a deep crease. When cut with a knife the inside of the grain shows mealy, and the bran appears thin, and this demonstrates one of the few deficiencies of this wheat, namely, starchiness. The flour will be beautiful and white, but deficient in gluten. The germ-sculpture is small, occupying only one-fourth the length of the grain. A faint back-crease is often visible.

This variety, like all other purple straw wheats, is delicate in constitution and requires at least fairly good land. It will not do very well in an adverse season or on badly drained ground. It is very liable to rust, but being a very early wheat, it will usually ripen its grain early enough to escape the bad effects of the warm moist weather likely to occur in October and November. If sown early it will ripen in most parts of New South Wales early in November if the season is fairly good. Hudson's Early Purple Straw is a very prolific wheat and is beyond question one of the very best of the purple straw sorts. It is not now grown to any extent here, but it is sure to come into favour as soon as it can be distributed and become known.

28. **Steer's Early Purple Straw.**—The good and bad qualities common to the purple straw wheats are exemplified in this variety, which, however, has as an offsetting merit its unusual earliness. It stools very well and is a rather tall sort with a strong, tough, stiff, rather hollow straw of medium thickness, which tapers but little and which though yellowish when ripe, is purple previously. The abundant foliage is characterised by large, wide, rather light green, drooping flags. The heads are typical purple straw-heads, that is to say, are rosy, bald, long and large, regular, compact, of uniform size or slightly clubbed at the tip only, square, erect, straight, acute at the tip but rather abrupt at the base, where there are only one or two sterile

spikelets. Though the fertile spikelets spread but little they contain three large grains at least. The chaff is above medium length, mucronate but blunt, presents a few long awns at the tip of the ear, is stiff, streaked with colour but dull, deep, round-backed, firmly attached and hugs the grain closely, so that shelling is prevented. When the grain is said to be large, long, straight, of medium plumpness, opaque, yellowish, rather flat-bosomed, blunt at the tip, rather blunt at the base, with a medium-sized brush and a close deep crease, it will be seen that its good qualities do not fall behind those of other purple straws, which are all notably good and particularly acceptable to Australian millers. A back-crease is rarely visible; the germ-sculpture is comparatively small. The interior of the grain is mealy and gives a beautiful flour, but with a high percentage of starch, and therefore less nutritious than those with a high proportion of gluten.

Though excessively liable to rust this variety is so early as to escape the worst part of an ordinary season, there being no reason why it should not be ready for harvest under favourable conditions early in November. To ensure this it must be sown early, and have good strong land well adapted to wheat-growing. It is a delicate wheat, requiring careful culture, and in a bad season is sure to suffer very much and to yield poorly or not at all. It is suitable to any district where the frosts are not severe, excepting, of course, the coast districts.

29. **Farmer's Friend.**—This is a most prolific sort when it comes to perfection. It is above the medium height, and the straw is dull in lustre, yellow or purplish, thick, furrowed, hollow, stiff and strong. The foliage is abundant and drooping, the flags being long, broad, of a light or medium green colour, and not glaucous. The long, smooth, rosy, straight, stout, erect, regular ears are bald, compact, clubbed at the tip, square, sometimes a little twisted, blunt at the tip, abrupt at the base, where there is seldom more than one sterile spikelet. The spikelets spread much and contain three or four grains. The chaff is dull in lustre, uniform in colour, long, rather acute, mucronate, short-awned towards the tip, long-awned at the tip, rather soft, deep and large, round-backed, firmly attached and pressed firmly against the grain. Shelling does not occur. The grain is large, or of medium size, of medium length, straight, of medium plumpness, opaque, yellowish, flat-bosomed, blunt at both ends, and has an abundant brush, a deep crease, and a mealy inside. A back crease is rarely visible. The germ-sculpture is one-third as long as the grain.

Farmer's Friend builds a strong dense stool, and is one of the most prolific wheats known to Australians. It is a delicate mid-season wheat, and does well only under favourable conditions. On bad or indifferent land, or in a season characterised by either marked heat or cold, wetness or dryness, or when poorly attended to at seed-time, it suffers considerably. It is very liable to rust and must be sown early on that account. It suits any but the coast districts, and is grown extensively in Victoria and elsewhere. Mr. Wm. Farrer is inclined to think that Golden Drop is one of the parents of this variety.

30. **Fillbag.**—Fillbag is a purple straw wheat, not differing essentially from Farmer's Friend in form. The smooth, rosy, straight, erect and regular ears, are bald, above the medium length, compact, crowded at the tip where they are often clubbed, square, blunt at the tip, rather abrupt at the base, where there are two or three sterile spikelets. Chaff and grain in all respects like the other typical purple straw wheats.

31. **Rattling Tom.**—So closely does this wheat resemble Farmer's Friend, that a description of the one will almost answer for the other. The samples that we have seen seem to be a little less prolific than Farmers' Friend, and the ears are perhaps less inclined to be clubbed at the tip.

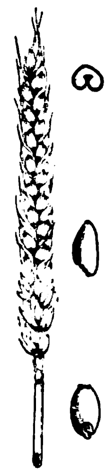


Fig. 71.—Rattling Tom.

32. **Red straw.**—This is a purple-straw wheat. It is above the medium height and has straw somewhat more decidedly red in colour than most purple-straws, becoming dull and brownish when ripe. The strong, stiff, coarsely furrowed straw is of medium and rather uniform diameter, very hollow, and of medium toughness. The sheath of the upper leaf is rather short. The large, smooth, erect, straight, regular, rosy, heads are of medium length, compact, clubbed at the tip, abrupt at the base, acute at the top, and present from two to four sterile spikelets at the base. The spreading fertile spikelets are three-grained. The chaff is dull and uniform in colour, long, rather deep, rather round-backed, rather blunt near the bottom of the ear, but acute and short-awned toward the tip, stiff, firmly attached and hugs the grain closely, so that little, if any, shelling occurs. The grain is large, long, straight, plump, opaque, yellowish, plump-bosomed, blunt at both ends, with a very abundant, brush, a very deep crease and a small germ-sculpture, namely, only one-fourth as long as the grain itself. A back-crease is occasionally visible. The grain is very mealy and white inside.

Red Straw is medium early, very liable to rust, stools well, and is very prolific in a good season, and yields a grain fetching the top price. It is a delicate wheat, requiring good land and good culture, and will do well only where there is little liability to rust. It resembles Northern Champion, Fill-bag, and other purple straws, and is grown in South Australia, and to some extent in New South Wales.

33. **Northern Champion.**—Another typical purple straw variety, above the medium height. The straw is dull in lustre, purplish, furrowed, hollow, of medium thickness, strong, stiff, and rather uniform in size. The yellowish or rosy ears are smooth, bald, of medium length, regular, compact, stout, clubbed at the top, square, erect, straight, blunt at the tip, tapering at the base, where there are four or five sterile spikelets. There are three grains in each of the spreading fertile spikelets. The chaff is dull in lustre, of medium length, bluntly mucronate near the base of the ear, but acute and short-awned at the tip of the ear, stiff, rather shallow, round-backed but having a distinct rib, firmly attached, and pressed close to the grain. The grain is of medium size, length and plumpness, straight, opaque, yellowish, flat-bosomed, blunt at the tip, blunt also at the base, and has an abundant brush and a deep close crease. No back crease is visible. On being cut in two the grain is seen to be mealy inside. The germ-sculpture is more than one-third as long as the grain.

Northern Champion is a very prolific, but delicate mid-season wheat yielding a first-class grain; but it is very liable to rust, and requires to be sown early and well, on good and suitable land. In a good season, like other purple straws, it stools freely and easily takes a leading position; but in bad seasons it brings up near the rear. Northern Champion is not yet known among farmers in this part of Australia.

34. **Steinwedel.**—This is another of the early and prolific but delicate and rust-liable, bald, purple-straw varieties, and one that stools abundantly. It originated in South Australia, but has found favour in many places outside that country. Its besetting fault is its liability to shell, and so great is this, that, unless the grower can put his machinery into the crop at will on any given date where the Steinwedel is ready, and go through his harvesting with good speed, he is sure to suffer much loss. Shortly after the grain commences to harden the chaff begins to break away, and the grain to fall out, and a few dry days is sufficient to allow a large percentage of loss, especially if winds prevail to knock the ears about a little. The stools are large and above medium height. The strong and stiff, though hollow, straw is of medium thickness, furrowed, slightly brittle, tapers little, and is of a dull purplish colour. The flags are large and drooping, and of a light-green colour, and decidedly weak The ears have prolific written large all over them; they are rosy, smooth—that is, not velvety—large, long, regular, compact, of uniform size, flattened obversely so widely spreading are the four to five grained spikelets, erect, straight, blunt at both ends, without sterile spikelets or with, at most, one. The chaff is of medium size, soft and rather thin, mucronate but blunt—the inner, however, with short awns below, and long ones towards the tip of the ear—shallow, round-backed, dull and uniform in colour; but, though crowded close upon the grain, loosely attached. The grains are large to medium in size, of medium length, straight, of medium plumpness, opaque, yellowish, somewhat flat-bosomed, or even angular-bosomed, blunt at both ends, with a fairly large brush, a deep open crease, and a large germ-sculpture. A back-crease is often visible, and the section of the grain is mealy.

Fig. 72.—Steinwedel.

The grain of Steinwedel is starchy, but of first-class milling quality, and consequently it brings a good price in Australia. Owing to its earliness this variety escapes rust in many districts if it is sown early and well on good land. It is unsuitable for coast regions. This is a good wheat for the wide-awake and energetic farmer, but the sleepy should beware of it.

35. **Jacinth.**—Browick and Golden Drop seem to us to be the nearest relatives of this variety, which is one introduced into Australia by Mr. Wm. Farrer. It is a rather tall sort having a hollow but fairly strong purple straw of dull lustre. The ears are bald, smooth, rosy or almost red, regular, of medium length, compact, of uniform diameter throughout the length, square, erect, straight, rather blunt at both ends, and present one to three sterile spikelets at the base. There are three grains in each fertile spikelet. The chaff is of medium length, rather acute, mucronate, short-awned towards the top of the ear, and rather long-awned at the tip; stiff, rather shiny, uniform in colour, deep, almost angular-backed, firmly attached, and lies close to the grain. There is little liability to shelling. The grain is rather large, of medium length, straight, of medium plumpness, opaque, yellowish, flat-bosomed, blunt at both ends, and has a rather deep crease, an abundant brush, and a mealy interior. A back-crease is occasionally visible. The germ-sculpture is two-sevenths as long as the grain.

Jacinth is a prolific mid-season wheat, more hardy than the purple straws, but about equally liable to rust. It must be sown early, and will not be likely to give satisfaction except on land well adapted to wheat.

36. **Golden Drop.**—Handsome and of medium height, prolific, stooling well and yielding a beautiful grain, Golden Drop would stand in the front rank, were it not for its great liability to rust. The almost semi-solid yellow straw is stiff, strong, of medium thickness, tough, and of a dull lustre. The abundant and drooping foliage is of a light green colour. The rosy ears are bald, smooth—that is, not velvety—of medium length, regular, their spikelets barely touching one another, slightly tapering upwards, square, erect, straight, blunt at the tip, tapering at the base where there are three to six sterile spikelets. The seed-bearing spikelets are spreading and contain three grains. The shortish chaff is mucronate in the lower part of the ear, short-awned at the tip of the ear, rather stiff, uniform in colour, almost shiny, round-backed but with a distinct keel, deep, firmly attached and lies close to the grain. The grain is large, rather long, straight, rather plump, opaque, yellowish, flat-bosomed, blunt at the tip, rather blunt at the base, and has a rather abundant brush, and a deep close crease and a small germ-sculpture. A back-crease is sometimes visible. The grain is starchy and of good milling quality.

Fig. 73.—Golden Drop.

Golden Drop is a delicate mid-season variety, excessively liable to rust,—even more so than the purple straws. It must be planted early and carefully on good soil in order to do well. It is totally unsuitable for districts where rust is prevalent. There is a greater resemblance between Golden Drop and Farmer's Friend than between Golden Drop and any other of the typical purple straws. Banham's Browick and Golden Drop resemble one another very closely, but possibly the Browick has the superior grain, this being the only difference, unless indeed the grain of Browick be a trifle more ruddy.

37. **The Blount.**—The Blount is below the medium height and stools well; the straw is of medium strength, medium thickness, and medium size, rather stiff, brittle, hollow, tapering but little, dull yellow or purplish in colour, furrowed, with joints not very prominent. The heads rosy, bald, of medium length, regular, compact, uniform in diameter or clubbed, square, stout, erect, straight, rather blunt at both ends, not velvety, with from two to five sterile spikelets at the base. Fertile spikelets spreading and three-grained. Chaff long, mucronate, blunt below but acute and short-awned at the tip of the ear, rather thin, dull and uniform in colour, deep, round-backed, rather loosely attached but lying rather close to the grain, so that but little shelling is likely to occur. The grain is large, above medium length, straight, plump, opaque, yellowish, flat-bosomed, rather blunt at both ends, with a very deep crease and a very abundant brush. The germ-sculpture is small—only one-fourth as long as the grain. A back-crease is occasionally faintly visible. The inside of the grain is mealy.

This is a very prolific but delicate purple-straw variety, only medium early. It is rust-liable and therefore suitable only for districts where rust is not prevalent. The grain is of very good milling quality. The variety is comparatively new to this country, and is not yet grown outside of experiment stations.

38. **Rattling Jack.**—This is an old and well-known sort which, however, has of late years gone out of favour in New South Wales. It is quite short and stiff and grows a dense stool. The straw is stiff and strong, of medium and rather uniform thickness, very hollow, only fairly tough, distinctly

furrowed, and purplish in colour. The sheath of the upper leaf reaches considerably more than half-way from the last joint of the ear. The foliage is abundant, light-coloured, and drooping. The bald, smooth, straight, erect, regular, short, rosy ears are clubbed, quite crowded, flattened, blunt at the tip, tapering at the base where there are three or four sterile spikelets. The three-grained spreading spikelets are supplied with chaff of medium length. In the lower part of the ear the chaff is bluntly mucronate, but at the tip of the ear there are several rather long awns. There is never any shelling for the reason that the deep round-backed chaff is stiff and lies very close upon the grain and is firmly attached. The crowding together of the spikelets also tends to prevent shelling. The grains are large, of medium length, straight, of medium plumpness, opaque, yellowish, rather flat-bosomed, blunt at both ends, especially the tip, with an abundant brush, a rather deep crease and a germ-sculpture occupying not more than one-third their length. A back-crease is rarely visible. The interior of the grain is rather mealy.

Rattling Jack may be called an abbreviated purple-straw wheat. Except in form it completely resembles the purple-straws, being delicate, and very liable to rust, but a great yielder in a good season and on good, well-cultivated land. Though the ears are short they contain a surprising amount of grain. This wheat will stand gales without breaking down and without much shelling. The grain is of very good milling quality. Grosse's Prolific is a variety closely resembling this, but is taller and has larger ears with fewer sterile spikelets at the base, and consequently tapering less in that part; it is more prolific than Rattling Jack.

Fig. 74.—Rattling Jack.

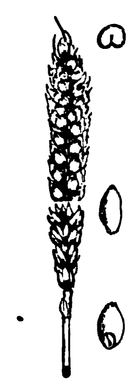


Fig. 75.—Fort Collins.

39. **Fort Collins.**—There is a striking resemblance between this variety and Rattling Jack, both being rather short wheats with purple straw and clubbed ears. The straw, though previously purple, is dull yellow when ripe, of medium thickness and strength, hollow, stiff, rather brittle, and tapers considerably. The smooth rosy ears are bald, short, regular, straight, erect, flattened, clubbed from the very base, crowded toward the blunt tip, very tapering at the base, where there are five or six sterile spikelets. The widely-spread, fertile spikelets contain three grains. The dull and uniform-coloured chaff is short, rather acute, with slightly bent mucronate tips, short-awned at the tip of the ear, rather stiff, rather shallow, round backed, close-lying, but loosely attached. In spite of this latter fact, however, shelling does not occur to any great extent, both the chaff and grain being prevented

from breaking loose by the close packing of the spikelets. The grain is rather small, of medium length, straight, almost hump-backed, plump and thick, opaque, yellowish, rather plump-bosomed, blunt at both ends, and has a small brush, a rather deep crease, and, proportionally, a very large germ-sculpture. A back-crease is often distinctly to be seen. When cut with a knife the interior of the grain is seen to be mealy and not horny.

Fort Collins is a prolific, but delicate and rust-liable, mid-season wheat yielding a grain of excellent milling quality. To do well it requires fairly good land, on which it grows and stools very well. There are too many sterile spikelets at the base of its ears, but this is a fault that might easily be remedied by a little selection. This variety came to this country from America, and has not yet been tried except at experiment stations.

40. **Frame's Early** is of medium height and stools well. The straw is dull in lustre, furrowed, rather fine, uniform in size, of medium length, thickness, and flexibility, semi-solid, of a yellow colour. The stalk when ripening is green, never purple. The bald, regular, compact heads are roseate in colour, rather short, slightly tapering, square, erect, acute at the tip, tapering at the base, smooth—that is to say, not velvety—and present from four to five sterile spikelets at the base. The seed-bearing spikelets are spreading and three-grained. The chaff is uniform in colour, deep, close-lying, firmly attached, short, somewhat angular-backed, stiff, rather shiny, acute at base of the ear, but short-awned towards top. The grain is of medium size and plumpness, straight, opaque, flat-bosomed, yellowish, pointed at the base, blunt at the tip, and presents a small brush. The crease is deep. A back-crease is often only faintly visible. The grain when cut appears horny inside. The germ-sculpture is large,—one-third to two-fifths as long as grain.

Fig 76.—Frame's Early.

This is an early and rather prolific sort, yielding a grain of good milling quality. It is not yet in general cultivation in this colony.

41. **Fountain.**—Fountain is a rather tall wheat, that stools well and gives good returns. It resembles the typical purple-straws to a certain extent, and like them it is a delicate wheat. The straw of this wheat is dull yellow, tall, strong, tapering, furrowed, hollow, of medium strength, flexibility and toughness. When ripening the stalk is green—occasionally somewhat purple. The stalk is four-jointed, and the joints are fairly prominent. The heads are rosy in appearance, bald, straight, erect, regular, slightly tapering, blunt at the tip, tapering at the base, where there are two or three sterile spikelets. The chaff is smooth—that is, not velvety—of medium size, close-lying, with short and bent awns near tip of the ear; it is mucronate with incurved points, acute toward the top of the ear but blunt below, somewhat angular backed, and uniform in colour. The grain is yellow in colour, of medium size and length, straight, opaque, horny, blunt at the tip, pointed at the base, having an abundant brush, and a rather deep close crease, a back-crease being often visible. Germ-sculpture rather small, only two-sevenths as long as the grain.

Fig. 77.—Fountain.

This is a very prolific sort, having a grain of good quality. It shells a little, and is not resistant to rust. It is not yet grown in Australia to any noteworthy extent.

42. **White Tuscan.**—This wheat is above the medium height. The dull yellow, coarsely-furrowed straw is thick, hollow, stiff, and strong. The yellowish or almost rosy ears are smooth, bald, long, very regular, a trifle open, a little tapering, square, erect, straight or slightly curved, rather acute at the tip, tapering at the base, where there are one to three sterile spikelets. The chaff is dull in lustre, rather uniform in colour, long, rather blunt low down, but mucronate or short-awned above the middle of the ear, and long-awned at the tip, stiff, deep, almost angular backed, very firmly attached, and hugs the grain closely, so that shelling never occurs. The grain is large, or at least of medium size, long, straight, of medium plumpness, opaque, yellowish, plump-bosomed, blunt at the tip, pointed at the base, and has an abundant brush, a moderately deep crease, and a mealy cross-section. A back-crease is occasionally visible. The germ-sculpture is one-third as long as the grain.

White Tuscan is a rather hardy, freely stooling, and quite prolific sort, of which a good strain is in general cultivation in New South Wales. It is but slightly resistant to rust, but yields a grain fetching the top price. In outward appearance White Tuscan somewhat resembles the purple straws. Mr. Wm. Farrer informs us that he doubts whether the specimens from which we draw our description are in reality White Tuscan.

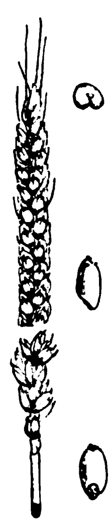


Fig. 78.—White Tuscan.

Fig. 79.—Agate.

43. **Agate.**—Short, almost dwarf, is the Agate. The rather shiny, whitish straw is furrowed, fine, almost semi-solid, strong, and of medium flexibility; at no stage is it purple. The smooth, rosy, erect, regular ears are short or of medium length, compact, tapering, square, straight, acute at the tip, tapering at the base, where there are from two to six sterile spikelets. The spreading fertile spikelets contain three grains. The chaff is short, blunt near the base of the ear, but acute at the tip of the ear, soft, dull and uniform in colour, loosely attached, but lies close to the grain. On account of the chaff falling away considerably, shelling occurs if the crop is not harvested promptly and

well. The grain is large, of medium length, straight, of medium plumpness, opaque, yellowish, rather flat-bosomed, blunt at both ends, and has an abundant brush, and a deep narrow crease; a back crease is often visible. The cross-section is mealy. The germ-sculpture is only two-sevenths as long as the grain.

Agate is liable to rust, but escapes it to some extent on account of being rather early, if it is put into the ground in good season. The grain is very beautiful, and of first-class milling quality, from the Australian point of view. It stools well, and is quite prolific, and may find favour with some.

44. **Red Tuscan.**—Like White Tuscan, but with a rather ruddy grain, and perhaps more decidedly purple straw, in fact reminding one of the purple straw wheats in form. We know very little about it.

45. **Ward's Prolific.**—This wheat has won great celebrity in Australia on account of its power to resist rust, in which respect it is certainly remarkable. It is a wheat a little above the medium height, with a fairly strong, fine, almost semi-solid straw, which tapers but little, and is of a dull yellowish colour when ripe, and glaucous when young—never purple. The plants have scanty foliage of an erect habit, with short, narrow, smooth, and more or less glaucous, dark green flags of remarkable toughness. Ward's Prolific stools only fairly well, its brown ears being of medium length, or long, regular, open, tapering, flattened obversely, erect or leaning a little, straight or nearly so, rather acute at the tip, smooth,—that is not velvety,—and tapering at the base, where there are three to five sterile spikelets. The spreading spikelets are rarely more than three-grained. Of course the chaff varies in form in different parts of the ear; towards the base it is mucronate, though the points are dull and turned inwards slightly; towards the tip, however, it is short-awned and sharp; it is of medium length, stiff, dull and uniform in colour, shallow, round-backed, firmly attached, and close-lying, so that shelling never occurs. The quality of the grain leaves something to be desired, according to Australian millers, but the flour though not so white as that from purple straw wheat is undoubtedly of good quality. The grain is of medium size, rather long, straight, of medium plumpness, opaque or horny according to season and locality, yellowish, rather flat-bosomed, blunt at the tip, rather pointed at the base, and has a small brush, and a rather deep, close crease. No back-crease is visible, and the germ-sculpture is small, being only one-fourth to two-sevenths as long as the grain. When cut the grain shows a horny interior.

Ward's Prolific does not yield so well as its name might indicate, on account of its spare habit of growth, but with a little above the usual amount of seed per acre it does fairly well. It mills only fairly well, though it is a wheat that varies in this respect. It is highly resistant to rust and suits all parts of New South Wales, but evidently requires several seasons in which to become acclimatised. It is of medium earliness. In outward appearence when nearly ripe Ward's Prolific resembles Allora Spring, but the grains of the two varieties are widely different.

46. **Clawson.**—In the United States this variety has been for many years a favourite. It is rather tall and has a smoothish dull yellow straw of medium size, tapering but little, and possessing all the good qualities in a medium degree. The red or brown, smooth, bald ears are rather long, curved, regular, a trifle open, flattened obversely, leaning when ripe, acute at the tip, tapering at the base, where there are four to six sterile spikelets. The seed-bearing spikelets spread widely and contain three grains. The chaff is long, dull and uniform in colour, blunt near the base of the ear, acute higher up, and short-awned at the tip, of medium stiffness, deep, almost angular

backed, loosely attached, and not lying close upon the grain. In consequence of these latter qualities the grain falls out freely soon after it is ripe, and unless the grower is observant, and prompt in harvesting, he will lose much of the crop. The grain is large, of medium length, straight, rather plump, opaque, whitish, plump-bosomed, blunt at both ends especially the tip, and has an abundant brush, and a very deep rather open crease. A back-crease is rarely visible. The germ-sculpture is two-fifths as long as the grain.

Clawson is a handsome free-stooling and very prolific mid-season wheat, yielding a beautiful grain of superior quality. It is not yet grown in this country. In appearance it resembles Red Provence, but the grain is more opaque and not so dark.

47. **Allora Spring.**—This is a variety which came to this country from California, under the name of Pugh's Rust-proof. In Queensland it has found some favour and has often gone under the name of Ward's Prolific or Queensland Ward's Prolific, owing probably to its outward resemblance to that wheat. The grains of these two wheats, however, are widely different, and the Allora Spring is very much the earlier. The present variety is that sometimes referred to as "ninety-day wheat" or "three months wheat," names which have also been applied to wheats of the Velvet Pearl type,—in both cases, on account of the extreme earliness. The present variety is below the medium height. The dull yellow furrowed straw is fine, semi-solid, a little too weak and brittle to be desirable, and but slightly tapering. The sheath of the topmost leaf extends less than half-way to the ear. The smooth, red, bald heads are of medium length, regular, open, tapering, square, erect, straight, acute at the tip, abrupt at the base, where there are one or two sterile spikelets. There are three grains in each of the spreading spikelets. The chaff is somewhat streaked with colour, dull in lustre, of medium length, blunt near the base of the ear, but short-awned a little higher up and long-awned at the top, of medium stiffness, shallow, almost angular-backed, rather loosely attached, and not lying very close to the grain, in consequence of which considerable shelling is likely to occur unless the grower is prompt and handy in harvesting. The grain is small or of medium size, short, straight, plump, opaque, whitish, flat-bosomed, blunt at the tip and also at the base, and has an abundant brush, a rather deep crease, and a mealy cross-section. A back-crease is generally visible. The germ-sculpture is two-fifths as long as the grain.

Fig. 80.—Allora Spring.

By its marked earliness this wheat escapes rust. It stools rather sparingly but yields fairly well, and its grain though small will be found acceptable to Australian millers. Allora Spring resembles to a certain extent the wheat next described—Californian Spring.

48. **Californian Spring.**—A rather short, early, beardless wheat, with reddish-brown ears. The dull whitish straw is fine, semi-solid, rather stiff, inclined perhaps to be brittle, of rather uniform size, not any too strong. The straw is green when ripening. The sheath of the topmost leaf reaches less than half-way to the ear. The joints are rather prominent. The heads are brown, bald, smooth, erect, straight, regular, compact, of uniform size throughout, square, acute at the tip, tapering at the base, where there are three or four

sterile spikelets. The fertile spikelets are spread out considerably and contain three grains. The chaff is dull in lustre, somewhat streaked with colour, of medium length, rather blunt at the base of the ear, but acute and short-awned at the tip, stiff, deep, round-backed, does not lie very close and is rather loosely attached. In consequence of these latter qualities some shelling takes place, but less than would be expected. The grain is of medium size, rather short, straight, plump, opaque, yellowish, plump-bosomed, blunt at both ends, and has a rather small brush and a shallow crease; a back-crease is visible. When cut across with a knife the grain shows a mealy interior. The germ-sculpture is a little more than one-third as long as the grain.

This is a fairly prolific sort, worthy of trial. It is not now grown in this country to any extent. It is early enough to fairly be called rust-escaping, resembling in this respect, as in some others, the Allora Spring.

49. **Red Provence.**—This is a French wheat with many good qualities. It is of medium height and has more, and rather more prominent joints, than the majority of fine wheats. While the straw is semi-solid, it is too fine to be very strong, being however somewhat flexible it breaks less on that account. It is furrowed, dull, brownish yellow in colour, and tapers but little. The sheath of the upper leaf is less than half as long as the distance from the upper joint to the ear. The long brown or brownish violet, smooth and regular ears are neither open nor compact, but intermediate, taper but little, and are flattened obversely on account of the well-spread three-grained spikelets; they lean a little when ripe, are slightly curved, acute at the tip, and taper also at the base, where there are from two to five sterile spikelets. The chaff is rather long, acute, mucronate, with short awns in the lower part of the ear and with long awns at the top; it is very stiff, almost angular backed, rather shallow, streaked with dull colour, firmly attached and lies rather close to the grain. The grain is red, large, of medium length, straight, of medium plumpness, horny, flat-bosomed or nearly angular-bosomed, pointed at the tip and rather pointed at the base also, with a rather small brush and a very deep close crease, and a germ-sculpture one-third to three-fifths as long as itself. A back-crease is often visible. Cut with a knife, the grain is seen to be horny inside.

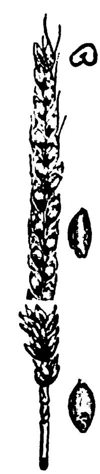


Fig. 81.—Red Provence.

Red Provence is a favourite wheat in southern France, where it does extremely well, especially on limestone soils, yielding a rich return in grain of superior quality. It stools well, but seems inclined to shell a little, and has somewhat weak straw. It is not yet grown in Australia, but will no doubt be found very suitable for the warm parts. This wheat resembles Robins' Rust Resistant in appearance when growing, except that the ears of the latter are straight and not nodding. The outward resemblance to Clawson is still greater, but the grains of the two wheats are quite different, that of Clawson being whiter, more opaque, and more attractive.

50. **Robins' Rust Resistant.**—A wheat above the medium height, that stools well and yields well. The straw is of medium length, stiff, furrowed, hollow or semi-solid, dull, slightly tapering, of medium strength and flexibility. The joints are prominent. The bald, erect, straight, square, regular heads

are of medium length and compactness, slightly tapering, acute at the tip, rather abrupt at the base, where they present from one to three sterile spikelets; they are smooth—that is, not velvety—and brown in colour. The spikelets are spreading and three-grained. The chaff is close-lying, very firmly attached, round-backed, has a distinct rib, is dull, shallow, of medium stiffness and length; the mucronate tips are bent inwards; it is short-awned toward the tip, and uniform in colour throughout. The grain is large, plump-bosomed, straight, rather horny, of medium plumpness, amber-coloured, blunt at the base, pointed at the tip, and possesses a small brush. The crease is open and deep; a back-crease is rarely visible. When cut with a knife the section of the grain appears horny. The germ-sculpture is one-third as long as the grain itself.

This variety originated in South Australia, and is a promising one in some respects. It resembles Red Provence and Clawson to some extent in outward appearance, but the ears are more erect. It is new to this Colony.

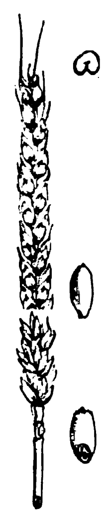


Fig. 82.—Robin's Rust-resistant.

Fig. 83.—Sicilian Square-headed Red.

51. **Sicilian Square-headed Red.**—Various observers have called this a typical rust-resistant wheat, and in some respects the statement is true. It certainly resists rust in a marked degree, owing no doubt to its very glaucous ears, straw, and foliage, and to the toughness of its tissues. Its grain however is small and unattractive, and it will be impossible to induce farmers to have anything to do with it. However, though it is a small wheat with small ears, it stools freely and yields well, and it will stand a very hot dry climate on almost any kind of good soil, clayey or limestone.

The straw is short, very strong, of medium thickness, very stiff, tough, hollow, of rather uniform diameter, dull white when young and purplish when ripe, furrowed. The foliage is rather scanty, erect, dark green, but rendered whitish or glaucous by an abundant waxy bloom. The ears are quite peculiar, being bald, short, regular, very compact and hard, of uniform size throughout their length, square, erect and rigid, straight, blunt at both ends, smooth and glaucous, red or brown in colour, and having from three to six sterile spikelets at the base. The three-grained spreading spikelets have

short, stiff, shallow, round-backed, fairly firmly attached, close-lying, dull and uniform coloured chaff which is blunt near the base of the ear, but acute toward the top and even has a few short awns at the tip. The grain is small, short, oblique, flat, of medium plumpness, horny or opaque, reddish, almost angular-bosomed, blunt at both ends, with a small brush and rather shallow crease reaching but little more than half-way through the grain. The germ-sculpture is large and oblique ; a back-crease is barely visible. According to the season and locality in which it is grown, the grain shows a horny or a mealy inside when cut in two with a knife.

The Sicilian Square-headed Red does not shell, and has another good quality in the fact that it ripens its grain with great rapidity, the time between the first appearance of the ear and the hardening of the grain being unusually short. On this account it is a fairly early sort. It is possible that this wheat may prove highly useful as a parent in getting new cross-breds suitable for Australian conditions. Tourmaline is a variety almost identical with this. Both will stand considerable wind, and may on that account and on account of their rust-resisting qualities be found of use in the coast districts.

52. **Velvet Pearl.**—This wheat will serve as an example of the red-eared velvet-chaffed varieties, a number of which seem to have originated, or to have been more particularly cultivated in California and Mexico. It is below the medium height, and has a rather shiny, yellow, fine, semi-solid straw, possessing all the good qualities in a medium degree. When ripening the straw is yellow, never purple. The sheath of the upper leaf is less than half as long as the distance from the uppermost joint to the ear. The ears are red and velvety, and this fact, together with the bright yellow straw, give the plants a particularly bright and attractive look. The ears are beardless, of medium length, very regular, compact, somewhat tapering, square, erect, straight, acute at the tip, abrupt at the base, where there are two or three sterile spikelets. The fertile spikelets are spread out wide like an open fan, and contain three grains. The dull and uniform coloured chaff is of medium length, acute and short-awned throughout the length of the ear, rather deep, round-backed, of medium stiffness, but rather loosely attached and not lying close to the grain, so that a little shelling is likely to occur unless the handling is well-timed and careful. The grain is smallish, short, very plump, opaque, whitish, flat-bosomed, blunt at both ends, with a shallow close crease, and a comparatively abundant brush. No back-crease is visible. When cut with a knife the interior of the grain shows up very mealy. The germ-sculpture is large, that is, two-fifths as long as the grain.

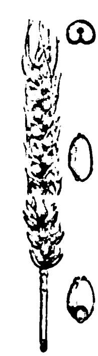


Fig. 84.– Velvet Pearl.

Velvet Pearl is a very early wheat, giving a grain of very good quality, but is only a fairly good yielder, as it stools rather sparingly. It will stand a dry climate, in fact seems particularly suited to such. Although the stools are small, this is easily compensated for by thicker sowing. The bulk of seed per acre is about the same as for other varieties, the seed being small. The wheats of which this is an example, seem to have come into favour in but few parts of the world. The variety known as Red Californian, with velvet chaff, appears to be identical with the present ; both resemble Allora Spring, but the latter has not velvet chaff. New Zealand Velvet appears to be the same as Velvet Pearl.

53. **Canning Downs Rust-resistant.**—This variety hails from Queensland. It is very early, and will ripen in time to escape rust. It is very short, even dwarf in stature, and stools rather sparingly, but nevertheless yields well with the right treatment. The dull yellow, furrowed straw is fine, semi-solid, flexible, tapering, and is a little too weak or brittle; at no time of its growth is it purple. The smooth, rather rosy ears are short, have spikelets barely touching each other, are tapering, square, erect, straight, acute at the tip, rather abrupt at the base, where there are two or three sterile spikelets. The beards are of medium length, rather orderly, brownish, very rough, of equal length, spread but little, and are not shed at maturity. The spikelets spread but little and are three-grained. The dull and rather uniform coloured chaff is of medium length, acute, stiff, shallow, angular backed, firmly attached and hugs the grain closely, so that shelling is not likely to occur. The opaque, yellowish grain is of medium size, length, and plumpness, is rather full-bosomed, blunt at the tip but tapering in that direction, pointed at the base, and has a small brush and a deep close crease. A back-crease is often visible. The germ-sculpture is two-fifths as long as the grain itself.

The name given to this wheat would imply that it has rust-resistant properties. It certainly is early enough to be a rust-escaping sort. The grain is of fairly good quality. In appearance, the Canning Downs Rust-resistant resembles a number of wheats now grown in India, and we believe that it is in fact related to them, if not of them. All such wheats are remarkable for their ability to yield something of a crop even on poor land and with bad treatment. It would be worth while to try such wheats carefully in the dry interior of New South Wales.

Fig. 85.—Canning Downs Rust-resistant.

Fig. 86.—Early Baart.

54. **Early Baart.**—Somewhat below the medium height and stools pretty well. The dull yellow, distinctly furrowed, uniform-sized, almost semi-solid straw possesses most of the good qualities in a medium degree. At no time in its growth is the straw purple. The smooth whitish ears are bearded, rather irregular, of medium length, compact, tapering, obversely flattened, erect, straight, acute at the tip, tapering at the base, where there

are three to five sterile spikelets. The beards are long, fine, not very orderly in arrangement, of unequal length, brownish in colour, spreading, and are not shed at maturity. The spreading fertile spikelets contain three grains. The chaff is of medium length, acute, stiff, dull in lustre, uniform in colour, rather shallow, angular-backed, firmly attached, and hugs the grain closely. The grain is rather large, long, straight, of medium plumpness, rather horny, amber coloured, flat-bosomed, blunt at the tip but tapering in that direction, pointed at the base, and possesses an abundant brush and a quite deep narrow crease. A back-crease is usually visible. The section of the grain when cut with a knife appears horny. The germ-sculpture is from two-fifths to one-third as long as the grain.

Early Baart is hardy, very prolific, and early, and therefore rust-escaping wheat, yielding a grain of good milling quality. It is free from shelling but the straw is none too strong. The wheat known as Stockton Defiance appears to be identical with Early Baart. That known as Du Toits is also so nearly identical that a separate description is unnecessary, the only difference being that the Du Toits has more regular ears and is a trifle less early, holds its grain less firmly, and has purplish straw. Its name would indicate that Early Baart is of Dutch, very likely South African, origin. It is grown to considerable extent in some parts of Australia, but less now than formerly.

55. **Barbu à gros grain; Mammoth-grain Bearded.**—A rather tall, bearded, freely-stooling red French wheat. The dull yellow, furrowed and hollow straw possesses all the good qualities in a medium degree; it tapers but little, and is not purple at any stage of growth. The sheath of the topmost leaf reaches more than half way to the ear. The smooth whitish heads are bearded, of medium length, regular, open, tapering, square, leaning when ripe, straight, acute at the tip, abrupt at the base, where there are three to five sterile spikelets. The beards are of medium length, fine, orderly in arrangement, whitish, of unequal length—that is, the lower ones are shortest—spread but little and are not shed at maturity. The dull and uniform coloured chaff is of medium length, acute, stiff, thick, rather deep, almost angular-backed, firmly attached, and hugs the grain closely. The large red grain is long, straight, of medium plumpness, horny, rather flat-bosomed, blunt at both ends though less so at the base, and has a small brush and a very deep and rather close crease; a back-crease is sometimes visible. When sectioned the grain is seen to be horny inside. The germ-sculpture is small, being one-fourth to one-third as long as the grain.

Fig. 87.—Barbu à gros grain.

The Mammoth-grain Bearded is a prolific sort, and yields a grain of good milling quality. It is not yet grown in Australia, except on experiment stations.

56. **Moscow.**—A short, bearded variety, resembling Lazistan, but not so early. The straw is of a dull yellow colour, short, strong, tough, distinctly furrowed, semi-solid, and of medium flexibility. When ripening the stalk is green, not purple. The sheath is long, reaching half-way to the base of the ear. The straight, erect, regular, bearded, heads are yellow, smooth—that is, not velvety—of medium length and compactness, obversely flattened, tapering,

acute at the tip, tapering at the base, where they present from five to six sterile spikelets. The beard is of medium length, whitish in colour, of unequal length, fine, pretty orderly, rather parallel, not shed at maturity. The spikelets are spreading, and are usually three-grained. The chaff is dull and uniform in colour, firmly attached, deep, angular-backed, of medium softness, not lying very close to the grain, acute at the base of the ear. The grain is of medium size and length, almost hump-backed, opaque, flat-bosomed, nearly straight, of a deep yellowish or dark amber colour, rather blunt at the base, blunt at the tip but tapering in that direction, and has a small brush. The crease is rather deep. A back-crease is often faintly visible. When cut with a knife the section of the grain appears horny. The germ-sculpture is large, being two-sevenths as long as the grain.

Moscow closely resembles the wheat known as Ladoga.

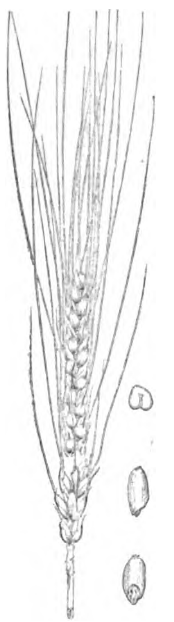


Fig. 88.—Lazistan.

57. **Lazistan.**—This is rather short, early bearded wheat. The straw is dull yellow in colour, furrowed, hollow, tapering, and possesses all the good qualities in a medium degree. The ears are bearded, of medium length, rosy, smooth,—that is not velvety,—regular, neither open nor compact but intermediate in this respect, that is, the spikelets barely touching one another, tapering, square, erect, straight, acute at the tip, rather abrupt at the base, where there are three to five sterile spikelets. The beards are light brown, of medium length, fine, orderly, spreading in two opposite directions, of unequal length, and are not shed at maturity. The spikelets are rather narrow, and are three-grained. The thin, stiff, round-backed, shallow chaff is dull and uniform in colour, firmly attached, and lies very close indeed upon the grain. On this latter account the red grains show through the rather translucent chaff, and the ear is given a ruddy appearance. The grain is red, of medium size, rather long, straight, of medium plumpness, horny, flat-bosomed, blunt at the tip though it tapers in that direction, rather blunt at the base, and has a small brush, a close deep crease, and a rather large germ-sculpture. A back-crease is occasionally visible. The interior of the grain appears horny when cut with a knife.

Lazistan is a rather early sort that stools and yields well. It is not yet introduced to Australian farmers, but is being grown at the seed-stations.

58. **Darblay's Hungarian.**—Above medium height. The yellow, somewhat shiny straw, is plainly furrowed, hollow, of medium thickness, strong. The smooth, yellow, erect, straight, bearded heads are long, rather regular, open, square, acute at the tip, abrupt at the base, where there are two or three sterile spikelets. The beards are of medium length or rather short, fine, not very orderly in arrangement, whitish, spreading, of unequal length, and are not shed at maturity. There are three grains in each of the spreading spikelets. The chaff is of medium length, the outer being long-awned, somewhat soft, shiny, uniform in colour, deep, almost angular-backed, firmly attached, and hugs the grain closely, so that little shelling occurs. The grain is of medium size, long, straight, of medium plumpness, horny, amber-coloured or red, flat-bosomed, blunt at the tip, but tapering in that direction,

pointed at the base, and has an abundant brush, a deep crease and a horny interior. A back-crease is sometimes visible. The germ-sculpture is two-fifths as long as the grain.

This is a hardy, prolific, midseason variety, hitherto unknown in this country.

59. **Cythere White.**—Cythere White is a bearded wheat, of medium height. The straw is dull yellow, at no time purple, very coarsely furrowed, of medium thickness, semi-solid, strong, though not strong enough for its large beads, of medium stiffness, rather tough, of rather uniform diameter. The sheath of the topmost leaf reaches more than half-way to the ear. The long, smooth, regular, whitish, erect ears are very open, very tapering, obversely flattened, straight, acute at the tip, tapering at the base, where there are from one to three sterile spikelets. The beards are of medium length, coarse, rather orderly in arrangement, nearly parallel, equal in length, and are not shed at maturity. The chaff is long, stiff, dull and uniform in colour, angular-backed, shallow, firmly attached and lies close upon the grain; shelling does not occur under ordinary circumstances. The grain is rather large, long, straight, rather thin, horny, amber-coloured, angular-bosomed, rather pointed at the tip, pointed at the base, and has a small brush, and a deep open crease. A back-crease is rarely visible. On being cut open the grain is seen to be horny inside. The germ-sculpture is one-third as long as the grain itself.

Fig. 89.—Cythere White.

The White Cythere stools fairly well, and is a good yielder; it is hardy and resistant to rust. The grain is not of the best, in which respect as well as others it resembles the Mammoth-grain Bearded and Moscow. It is not yet grown to any extent in Australia.

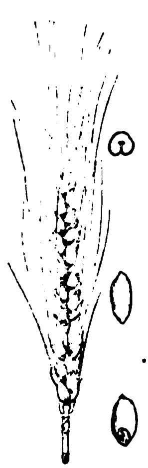


Fig. 90.—French Early Bearded.

60. **French Early Bearded.**—In height this variety is a little above the medium. The dull-yellow, almost semi-solid straw is rather fine, but is moderately strong, stiff, and tough. The bearded, rosy ears are regular, compact, of uniform width, square, erect, straight, abrupt at both ends especially the tip, and present only one or two sterile spikelets at the base. The beards are long, fine, orderly, brownish, of unequal length, spread but little, and are not shed at maturity. There are three or four grains in each of the spreading spikelets. The rather dull and uniform coloured chaff is of medium length, acute, deep, round-backed, very firmly attached, and lies close to the grain. This latter is of medium size, of medium length, straight, of medium plumpness, rather opaque, amber-coloured, plump-bosomed, pointed at the base and inclined to be so at the tip, and has a rather small brush, and a rather deep and close crease. When cut with a knife the interior of the grain appears horny. A back-crease is visible near the tip of the grain only. The germ-sculpture occupies one-third of the length of the grain.

This variety stools well, and yields well, but it is doubtful if it can be introduced into this country on account of the objection of the threshers to bearded wheat of any kind.

61. **Anglo-Australian.**—This variety is highly resistant to rust, and on that account alone included here. It is a little above the medium height. The dull yellow, furrowed straw is of medium thickness, hollow, strong, rather flexible yet rather tough, and tapers but little. The joints are prominent. The sheath of the topmost leaf extends upwards to near the base of the ear. The smooth, rosy, long, open, erect, regular ears are bearded, bald, a little tapering, rather square, straight or slightly curved, acute at the tip, tapering at the base, where there are as many as four to six sterile spikelets. The beards are long, fine, rather straggling, whitish, spreading, unequal in length, and are not shed at maturity. The narrow spikelets contain three grains, as a rule. The chaff is dull and uniform in colour, rather long, stiff, deep, angular-backed, firmly attached, and lies close to the grain. Shelling occurs freely. The grain is of medium size, of medium length, straight, of medium plumpness, horny, red, flat-bosomed, blunt at the tip but tapering in that direction, pointed at the base, and has a small brush, and a rather shallow close crease. A back-crease is visible. On being cut open with a knife the grain is seen to be horny inside. The germ-sculpture is one-third as long as the grain.

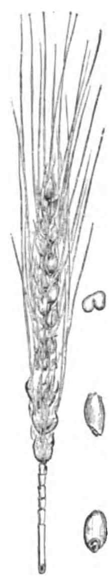


Fig. 91.—Anglo-Australian.

This wheat is a mid-season one, not very prolific, yielding a grain not approved by Australian millers. It may prove useful in securing new resistant cross-breds. It is a wheat well known to experts, and seed can be procured in most of the Australian colonies from their respective Departments of Agriculture. The upper node is short—a prominent characteristic.

62. **Bearded Herisson.**—The Bearded Herisson is above the medium height. The straw is purple, furrowed, dull coloured, hollow, strong and rather stiff, and tapers but little. The smooth, rosy, glaucous ears are bearded, of medium length, somewhat irregular, crowded, clubbed, square, erect, straight, blunt at the tip and also at the base, where there are one or two sterile spikelets. The fine whitish beards are rather short, straggling, spreading, of unequal length, being short near the base of the ear, and are not shed at maturity. The spikelets spread widely, and contain four grains. The chaff is short, stiff, dull and uniform in colour, deep, almost angular-backed, firmly attached, and lies close to the grain, so preventing shelling. The grain is small, short, straight, plump, opaque, red or ruddy-brown, flat-bosomed, blunt at the tip, somewhat pointed at the base, and has a small brush, a mealy cross-section, and a deep crease. A back-crease is generally visible.

The Bearded Herisson is a variety that is suited to land of indifferent quality, even in cold and mountainous districts. It is pretty certain to yield something of a crop under almost any circumstances within reason. It is essentially a poor-country wheat. The grain is of fair quality.

63. **Rieti.**—Rieti is a wheat somewhat above the medium height. The straw is dull in lustre, rather smooth, yellow, hollow, fine, of medium flexibility, strong, and tapers but little. The sheath of the topmost leaf reaches

more than half-way to the ear. The smooth, red ears are bearded, long, regular, open, tapering, flattened obversely, leaning when ripe, straight, acute at the tip, abrupt at the base, where there are as many as four to six sterile spikelets. The beards are long, fine, rather orderly in arrangement, brownish, spreading, of unequal length, that is shorter below, and are not shed at maturity. The spikelets spread somewhat and contain two grains. The chaff has a dull lustre, is uniform in colour, of medium length, rather stiff, thin, rather shallow, round-backed, rather firmly attached, and lies close to the grain. There is considerable shedding. The grain is large, long, of medium plumpness, horny, red, flat-bosomed, blunt at the tip but tapering in that direction, pointed at the base, and has a small brush, a deep close crease, and a horny cross-section. No back-crease is visible. The germ-sculpture is less than one-third as long as the grain.

Rieti is a rust-resistant mid-season wheat, not very prolific. It may be useful as a parent in securing resistant cross-breds. The seed came to this country from France. Anglo-Australian resembles this variety in outward form, but its ears are white while those of Rieti are red.

64. **Early Japanese.**—Like many other Japanese products, this wheat is very peculiar. Its grain will not be acceptable to millers. It is described here because it is likely to come into use as a parent in making cross-breds where earliness is desired. It is a bearded wheat a little above the medium height. The rather smooth, bright, shiny, yellow straw, is fine, hollow, of medium strength, somewhat flexible, not brittle, and tapers decidedly. At no stage of growth is the straw purple. The joints are prominent and brown. The smooth, brown ears are bearded, short, rather irregular, have spikelets barely touching each other, are tapering, square, erect, straight, acute at the tip, abrupt at the base, where there are four or five sterile spikelets. The beards are rather short, fine, straggling, brownish, spreading in all directions, of unequal length, and are not shed at maturity. The spikelets are spread widely like an open fan and contain three grains. The dull and rather uniform coloured chaff is short, acute, mucronate, of medium stiffness though thin, fairly deep, round-backed, pretty firmly attached but does not lie close upon the grain. In spite of this latter fact less shelling takes place than would be expected. The grain is small, of medium length, straight, somewhat hump-backed, pretty plump, opaque, yellowish or brownish, flat-bosomed, blunt at both ends, especially the tip, and has an abundant brush, a fairly deep crease, and a rather small and simple germ-sculpture. The back-crease is unusually plain. A section across the grain shows it to be unusually mealy inside.

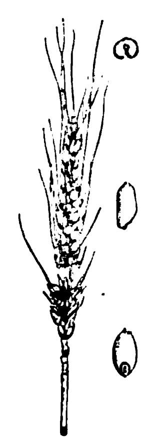


Fig. 92.—Early Japanese.

Early Japanese does not stool very freely, but in spite of this fact it yields well, and is early enough to escape the warm moist weather of mid-summer. It is a handsome and striking wheat when growing, and bears a faint resemblance to the wheat known as Ladoga, but the relationship between the two, if it exists at all, must be distant.

65. **Miracle or Mummy.**—This is one of the few poulard wheats that have found a certain degree of favour in Australia, more especially, we believe, in Queensland. It is of medium height, and is easily recognised by its

multiple or compound ears, a way of growing which has caused it to be sometimes dubbed "Hen and Chickens." The dull yellow, furrowed straw is solid, fine, flexible but strong, and tapers but little. The foliage is drooping, rather abundant, and of a light green colour. The smooth, glaucous, brown ears are multiple, that is, compound at the base, bearded, of medium length, irregular, crowded, tapering, flattened much, leaning straight or curved, blunt at the tip, abrupt at the base, where there are several sterile spikelets. The whitish or brownish beards are of medium length, fine, straggling, somewhat parallel, of unequal length, and are not shed at maturity. The narrow spikelets contain two grains. The chaff is short, very blunt, soft and thin, dull and uniform in colour, deep, very angular-backed, firmly attached, and lies close to the grain. Shelling is not likely to occur. The grain is of medium size and length, curved, hump-backed, of medium plumpness, opaque, yellowish, flat-bosomed, blunt at the tip, pointed at the base, and has a small brush, a crease of medium depth, and a very mealy cross-section. A back-crease not visible.

The Miracle or Mummy is a hardy, rust-resistant, fairly prolific, mid-season wheat, yielding a grain of only fair quality. The Queensland millers are said to pay a good price for it. A farmer on first seeing a good sample of Mummy growing is apt to be quite taken with it, judging from the compound ears that it will be a great cropper; it is disappointing in this respect, however, as it stools rather sparingly and is not remarkably prolific. There is a strain of Mummy having white ears that appears to be the best.

Fig. 93.—Mummy.

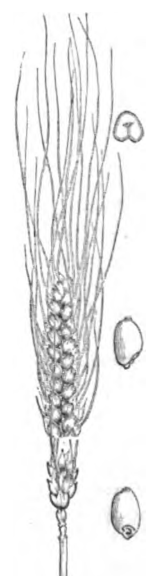


Fig. 94.—Smooth White Poulard or Algerian

66. **Smooth White Poulard, or Algerian.**—Like most poulards, the Algerian or Smooth White Poulard is a very tall wheat, and has stiff, coarse and tough, solid straw with large and prominent joints; in colour the straw is yellow. The ears are whitish, bearded, smooth, long and large, regular, very compact, somewhat pyramidal, flattened,

erect or leaning, straight or slightly curved, blunt at both ends, and present only one or two sterile spikelets at the base. The beards are long, coarse, orderly in arrangement, whitish or brownish, parallel, and are often shed at maturity. Each spreading spikelet contains three grains. The chaff is rather short, somewhat blunt, not mucronate, softer than one would expect in an ear of such dimensions, almost shiny, very deep, the outer being edged with brown or purple, angular-backed, firmly attached, and hugs the grain very closely, and holds it well. The grain is large, of medium length, a trifle curved, very markedly hump-backed, and in consequence very unusually thick, very plump, opaque, yellowish, plump-bosomed, very blunt at the tip, rather blunt at the base, and has an abundant brush, a rather shallow and open crease, and a very mealy interior; no back-crease is visible. The germ-sculpture is one-third as long as the grain.

This is a mid-season variety adapted to poor soil and other adverse conditions. It will yield something with little care and on cold wet soils where the drainage is poor —in a word, under circumstances where most wheats would be a failure. It is resistant to rust and is a very prolific sort; but the grain, though handsome, is of poor milling quality. It succeeds in coast districts. Algerian resembles Galland's Hybrid in appearance, but the form of grain and the colour on the outer chaff serve to distinguish the one from the other. Both have been grown in Australia for some years, but not extensively. The grain is used for chicken-feed.

67. **Galland's Hybrid.**—Very tall and coarse is Galland's Hybrid, otherwise known as American Centennial, and to the French as *Pétanielle blanche.* The coarsely furrowed, yellow straw is dull in lustre, thick, stiff and strong, solid or nearly so, and of rather uniform diameter. The joints are large and prominent. The large, long, smooth, whitish or yellowish ears are bearded, very regular, compact, somewhat tapering, flattened, erect or leaning, straight or but slightly curved, blunt at both ends, and present but one or two sterile spikelets at the base. The beards are long, coarse, rather orderly in arrangement, whitish, nearly parallel, and are shed at maturity. The chaff is short but large, the outer being blunt, shiny, rather soft, uniform in colour, deep, very angular-backed, not very firmly attached, and hugs the grain so closely that shelling is not likely to occur. The grain is large, long, curved, rather hump-backed, of medium plumpness, opaque or horny, but usually the former, yellowish or amber-coloured, flat-bosomed or angular bosomed, blunt at the tip but tapering in that direction, very pointed at the base, and has a small brush, a deep crease, and a rather horny cross-section,

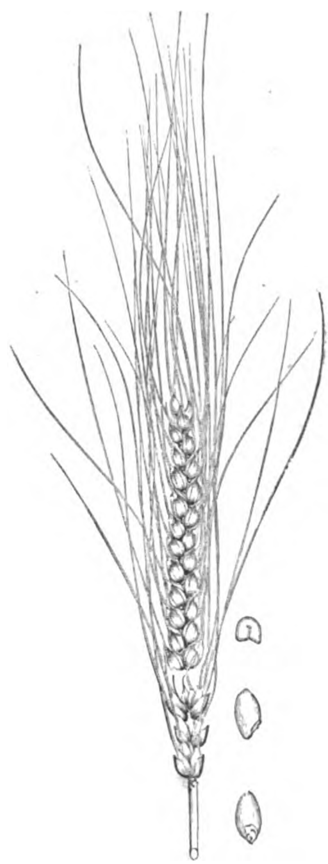


Fig. 95.—American Centennial.

though mealy when the grain is opaque and yellowish. A back-crease is rarely visible. The germ-sculpture is two-fifths as long as the grain itself.

Galland's Hybrid is an enormously prolific, hardy, rust-resistant, mid-season or somewhat late variety. It has been known to yield ninety bushels to the acre. The grain is very inferior for flour, and is used for fowls. In appearance this variety resembles Algerian, and to a less extent the larger *durums* such as Xeres. It is grown in many parts, but not extensively. It will flourish on poor soil, and with little care.

68. **Medeah.**—This is one of the solid-strawed, bearded wheats belonging to the species *Triticum durum*. Like other *durum* wheats, it is a tall rank-growing wheat and does not produce a stool with many stalks. The straw is very strong, solid near the ear, of medium thickness, stiff, though it usually bends under the weight of the heads, very tough, dull-yellow-coloured, tapering;

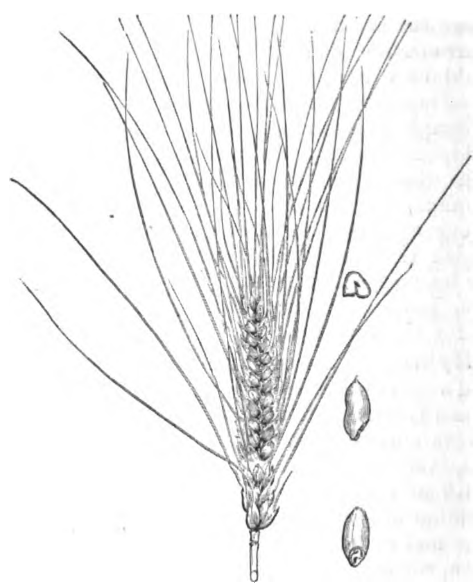


Fig. 96.—Medeah.

it is never purple. The sheath of the upper leaf reaches three-fifths the distance to the ear. The joints are prominent and brown; the large leaves are thin and drooping; the large flat ears are brown, glaucous, regular, and are made decidedly handsome by the long straight dark-coloured beards. Although only of medium length, the ears are so crowded with grain that they lean over on the stalk on account of their great weight. In form they are straight, of uniform size throughout or slightly clubbed, and blunt at both ends. There is seldom more than one sterile spikelet at the base of the ear. The beards are coarse, orderly, brown or black, spreading or nearly parallel, of equal length, the lower being only a little shorter, and they are often shed at maturity. The three to four grained spikelets are widely spread out in the form of a fan, and are free from down, except on the mid-ribs. The

long, stiff, and thick chaff is very firmly attached, and lies very close upon the grain, so that there is no chance of the grain falling out and being lost. The chaff is angular-backed, and deep, and of a streaky brown colour. Like other *durum* wheats, the Medeah has a large and long, often somewhat curved and rather thin grain. The grain, however, is often opaque and of a yellowish colour instead of being horny and amber-coloured. It is pointed at both ends, presents a close and very deep crease, and even occasionally a faint back-crease; the germ-sculpture is very large and the cross-section horny.

This wheat is a very prolific one, hardy, of medium earliness, and so resistant to rust that it can be grown even in coast districts, but it is not of very good milling quality. The bread made from it, although it is not so white, and fails to rise as well, as that made from finer wheats, is very nutritious and has a flavour surpassing that used in most English-speaking countries, where the demand is for *white* bread, regardless often of other things. On account of its so-called solid straw, this wheat yields a great weight of hay per acre, and it may be recommended on that account, but it remains to be shown that this hay is of as good quality as that from fine wheats. Medeah is grown extensively in the countries surrounding the Mediterranean Sea, especially in Algeria and other North African countries.

69. **Belotourka.**—This is a hard wheat from Southern Europe, and has been introduced into Queensland more extensively than elsewhere in Australasia. The grain is superior to that of most hard wheats. Belotourka is a very tall wheat, whose dullish yellow furrowed straw is solid or nearly so, of medium thickness, and flexibility, strong, and tapers but little. The drooping, light-green foliage is rather scanty considering the great size of the plants; the sheath of the uppermost leaf reaches less than half-way to the ear. The smooth light-brown ears are bearded, regular, very compact, of uniform width, strongly flattened, leaning when ripe though perfectly straight, blunt at both ends, and have only one of two sterile spikelets at the base. The fine brownish beards are long, very orderly in arrangement, parallel or nearly so, of equal length, and are rarely shed at maturity. The spreading spikelets contain three grains. The chaff is glaucous, dull and uniform in colour, of medium length, rather bluntly mucronate, and like that of all other hard or *durum* wheats, angular-backed, deep, firmly attached, and lying close upon the grain. Shelling never occurs under ordinary circumstances. The grain is large, long, straight or slightly curved, of medium plumpness, opaque or horny according to season and locality, yellowish or amber coloured, rather plump-bosomed, somewhat pointed at the tip and also at the base, and has a small brush, a rather mealy cross-section, and a germ-sculpture occupying only two-sevenths of its length. A back-crease is not visible.

Belotourka is a hardy, prolific, and rust-resistant mid-season variety having many fine qualities. It is bearded, and dreaded by threshers on that account. We believe, however, that there would be little difficulty in getting, by selection, a strain of this variety that would shed its beards at maturity, as we have noticed that the plants vary considerably in this respect. Like most bearded wheats it does not stool freely. On account of its coming quickly to maturity and resisting rust to a very considerable degree, Belotourka can be sown late if necessary. It is a wheat that may prove serviceable in coast districts as well as elsewhere.

70. **Xeres.**—The larger white-eared *durum* wheats are typified in Xeres, which is a tall and very handsome variety. In form and in the shape of the grain it closely resembles Medeah, but is readily distinguished by its white ears with light-coloured beards. The grain is inferior in quality to that of Medeah

and Belotourka. A wheat to which Mr. Wm. Farrer has given the name Bancroft, and which was sent to New South Wales by Dr. Bancroft of Brisbane, is similar in appearance to Xeres, but the ears of Bancroft are covered with a prominent velvet.

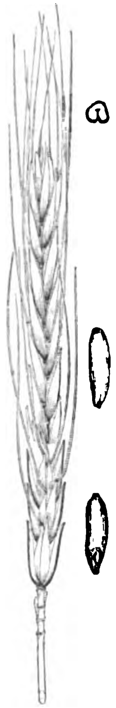


Fig. 97.—Poland.

71. **Poland.**—The chaff of the Poland or Polish wheat is enormously developed, resembling leaves rather than ordinary chaff, and in consequence of this the ears are very large. The stalks are not very numerous but very tall. The straw is dull in lustre, yellow, at no time purple, distinctly furrowed, solid, of medium thickness, flexible, but strong. The ears are very long and large, yellow, bearded, smooth, fairly regular, a trifle open, a little tapering, flattened, leaning or drooping, curved, blunt at the tip, tapering at the base, where there are three or four sterile spikelets. The beards are long, fine, straggling, whitish, parallel or spreading, of unequal length, and are sometimes shed at maturity. The chaff is very abundant, extremely long and foliacious, blunt, soft, dull in lustre and uniform in colour, deep, angular-backed, firmlyattached, and lies loose in the ear; shelling does not occur. The grain is very hard, very large and long, straight, thin, horny, dark amber-coloured, angular-bosomed, blunt at the tip, pointed at the base, and has an abundant brush, and a deep crease. A back crease is rarely visible. The grain is horny inside. The germ-sculpture is often less than one-third as long as the grain.

This peculiar variety is useless for flour. It is used for hay in some parts of Europe, and also for green fodder; and this leads us to call attention to it here as being worthy of trial for those purposes in this country. The grain is rich in gluten, and is suitable for macaroni. It is much grown in North Africa,—for instance in Egypt, and Algeria. It is sometimes called Mammoth Rye.

Among the wheats we have just described are representatives of four distinct species, namely:—

Triticum sativum or Fine Wheats, *e.g.*, Purple Straw, Talavera.
Triticum durum or Hard Wheat, *e.g.*, Belotourka, Medeah.
Triticum turgidum, Poulards, *e.g.* Mummy.
Triticum polonicum, Polish Wheat, *e.g.*, Poland.

These different species are easily distinguished one from another. The latter three, *durum*, *turgidum*, and *polonicum*, are always bearded, and have a straw which near the ear is solid or nearly so. These two characters are sufficient to distinguish them from the fine wheats which always have a hollow or at most only semi-solid straw. The Polish wheat is easily distinguished by its immense ears with enormously developed chaff. To distinguish a Poulard from a *durum* is not so easy, but it can be done with certainty if the following facts are carefully considered:—1. The chaff of the Poulards is thin, soft, and short, while that of *durums* is thick, stiff, and usually long. 2. The grain of the Poulards is rather soft, short, and plump, and usually decidedly hump-backed, while that of the *durums* is nearly always long, hard, and horny, seldom plump, and almost never hump-backed. 3. While the Poulard grains are very mealy inside, the *durums*, as a rule, are not so.

Economical Silage Stack.

At the present day there is little need of impressing on the thoughtful, intelligent members of the farming community the value of silage as a means of conserving fodder for winter use. There is, however, still much to be learnt regarding economical methods. We have, therefore, much pleasure in presenting our readers with an excellent drawing, made from a sketch on the spot, by Mr. E. M. Grosse, the departmental artist, of a stack which has recently been made by Mr. Herbert Throsby, of Moss Vale, together with that gentleman's valuable notes on the subject of silage. It should be pointed out by way of introduction that the points which render Mr. Throsby's system particularly valuable are many. To begin with, all the wood required is rough timber which can be procured on most farms by the aid of an axe. The only portions of the plant requiring to be purchased are three blocks, a pair of iron "grippers" or jaws, some wire rope, and some ordinary hempen rope. The method of raising the fodder is also worthy of careful note. To the left of the lower view of the plate will be seen a rough mast to which is fitted a spar with jaw attachment working on the mast. At the base of the mast is a winch to which the jaws are attached by means of a rope for raising the green fodder, and the movable spar allows of its being placed on the exact spot selected by the man on top while the gripper quickly and effectively grasps or releases the bundles of fodder. By means of these arrangements a man at the winch, a man to stack, and a boy to work the jaws, are the only assistants required.

Mr. Throsby's contribution is as follows :—

" The importance to dairy farmers of keeping up something like a uniform supply of milk to Sydney, and to the co-operative factories during the winter months, when the price of butter is high, should make those farmers consider carefully the different ways in which this end can be attained, and with this in view we purpose discussing the subject from different points.

"When the late T. S. Mort, Esq., originated the system of supplying country milk to Sydney, he supposed, erroneously as it turned out, that he could freeze the milk into blocks in a similar manner as water can be frozen into ice for use in the city, and the only stipulation he made with his first suppliers was that they should deliver the whole of their milk daily, subject of course, to ordinary tests, and its arrival at Harbour-street works sweet and in good condition. Mr. Mort soon discovered that when milk was so frozen the water and fats separated, and when thawed did not amalgamate as milk, and so he had to abandon the process. He then found that the milk received daily must only be cooled to say about 39° Faht., and be kept slowly moving to prevent the cream rising to the top. Then the difficulty soon presented itself of the irregular supply delivered in the spring and winter months, which from the cold district of Moss Vale and Bowral varied one-half between the months of plenty and those when the suppliers had to feed their cows, not only to get a fair supply, but literally to keep their cows alive. Then came

the pinch on the farmer, for he soon found that if he fed during say, five months—May to September—he required a higher price, which very often did not pay for the feed consumed, and ate up what profit he had made during the time when grass was plentiful.

"Some held that it was cheaper to purchase newly calved cows for the winter, and in the spring sell them as stores, but this soon exploded, for when the industry was first started the difference in price between the newly calved cow and the store was not so great as in after times, for the former rose in value, and the latter fell off.

"Then came the question 'what feed to use to keep up the supply, and what will the cost be"? For a time the principal artificial food was bran, but the farmer soon found that the cows 'ate their heads off,' and also his summer profit, and this brings us to the subject under notice, for since the starting of butter factories the same difficulty crops up as in the supply of milk to Sydney from the country, viz., the variation of the supply between the plentiful time and the months when the grasses are naturally resting.

"For the regularity of supply to the factories means an even supply of butter to the consumer, and, therefore, a uniform price, without the fluctuations which tend so much to disorganise the market. These fluctuations are not made in the interest of the dairy farmer, but for the benefit and profit of speculators, be they agents or not, who have purchased and stored in cool chambers, and therefore must raise the price to save loss.

"Some wise-acre will at once exclaim, 'take the necessary feed out of the land, and give it to your cows, by cultivating green feeds.' But here comes another difficulty: In the cold districts green stuff drawn and thrown out is hardly worth the candle, for experience has proved that by so doing, even if the conscience of the farmer is eased, the feeding is of little value to his cows, either as a heat-producer or milk-maker, and the percentage of waste is very great. The reason of the failure of this slipshod and wasteful mode of feeding is not far to seek, and simply arises from the fact that in the majority of milking sheds there is no convenient manger in which to place the feed. All who have tried it will own that, if you have enough bails and mangers, cows milk better when fed at milking, for the simple reason that each and every cow gets her fair ration, and the weak have not to go to the wall, which means that they stand aside until a few bullies walk over the stuff, and having eaten what they like, and spoiled the rest, allow the others to get what they can.

"Before a farmer can expect to do any good for himself, he must erect a convenient number of bails, arranging them in such manner as to save labour in feeding, and obtain for his employees (whether his own kith and kin or hired helps) shelter and convenience. The building of such a shed should be done by the landlord if on leased land, charging the tenant a fair percentage on outlay, which no tenant would object to.

"The old-fashioned idea that bails must be 6 feet wide and 8 or 9 feet long, is a wrong one, for practice has proved that a bail 5 feet wide and 7 feet long is more convenient, even for handling young heifers, than the other—the roof extending at the back, say, 4 feet for shelter in wet weather for those who do the leg-roping and carrying the milk; a manger 2 feet wide, and a covered way in front of mangers 9 feet wide by 9 feet high, to allow a tip dray to be drawn through and deposit the green stuff, which then can be easily fed to the cows as they are milked. Of course another set of bails erected in the same way could be had on the other side of covered way, and for large herds this would be a great convenience.

"The cheapest and lightest way of enclosing the ends and top side is by nailing on 3 x 1 battens at about 2 feet 6 inches or 3 feet apart horizontally, and nailing sawn or split palings on to the battens. The palings will last a lifetime, as proved by the length of time good paling fencing lasts in all parts of the Colony.

"Supposing it is agreed that it is economical to feed in such a shed at milking times, let us now take up the subject of what is best to feed to cows.

"Green feed, such as barley and tares, oats or rye, will appear at first to be the cheapest stuff to give; but experience has shown the great amount of loss and labour connected with the daily cutting and carting, especially when the weather is wet, and the ground saturated. For men have to go out and cut and handle the crop, not weather permitting, but whether they like it or not, which not only makes them discontented, but also poaches the land, and knocks the horses about very much. In some seasons, also, it is likely that a crop sown in February gets a check from want of rain or early frosts, and the farmer is left to face the winter under the old and expensive method of spending all he can make in buying bran and chaff.

"Now comes the suggestion that it is better to sow maize in October (preferably in drills) to cut in March, when the days are long and warm, and make into silage, and by this means the farmer will have his winter feed in the best possible form, and as near his milking bails as he chooses to make his stack.

"By sowing rather thickly, in drills about 3 feet 6 inches apart, the ground between the rows can be stirred and kept free from weeds. By this means the crop grows very quickly, and the quality is improved through the free circulation of light and air amongst it. A man can scarify from 3 to 4 acres per day according to the length of the rows, and even in a growing season like this, three scarifyings are all that are required. On ordinary good land a crop of 15 to 20 tons to the acre can be secured, especially if a light dusting of artificial manure be put under the seed to give the corn a start, thereby enabling the roots to take possession of the ground at once. Another advantage of drilling is that the crop can be cut more easily than if the corn was sown broadcast, for one man with a cane knife, can cut and lay in bundles at least 10 tons per day. The corn should be laid in heaps, with the tops all one way, so that in loading the drays (which must be done by hand) the stuff is packed in armsfull, taken to the stack and tipped out, and it is then in the best form for putting on the stack, as will be explained further on. A corn recommended for ensilage is Hogan spindle (large), as it grows high and not too stout in the stalk if sown evenly in the rows.

"Now let us suggest the mode of stacking and pressing. There are numerous methods of pressure, notably by strong wire ropes placed over the stack at intervals of 3 feet, and also by weighting with stones, &c., giving a continuous pressure. Although the latter is theoretically the best, the difficulty of making the sides and ends as solid as the middle of the stack is against this mode, for when the edges sink the loose stones, &c., are liable to slip off. The form of stack foundation, &c., now recommended, is, as will be seen, both cheap and reliable, and can be constructed by any ordinary bush hand, of course excepting the wire ropes.

"For a stack of 70 tons, take seven logs, 16 feet long x 9 or 10 inches diameter at smaller end. At 9 inches from each end saw in about 3 inches, and adze off the shoulder. Place these logs upon a level place near the bail, at 3 feet apart, centre to centre, adzed face down. Fill up to level of tops and make solid. Two strong pieces, rails or scantling, should be laid across the three end logs at each corner, 3 feet apart, to prevent the outside

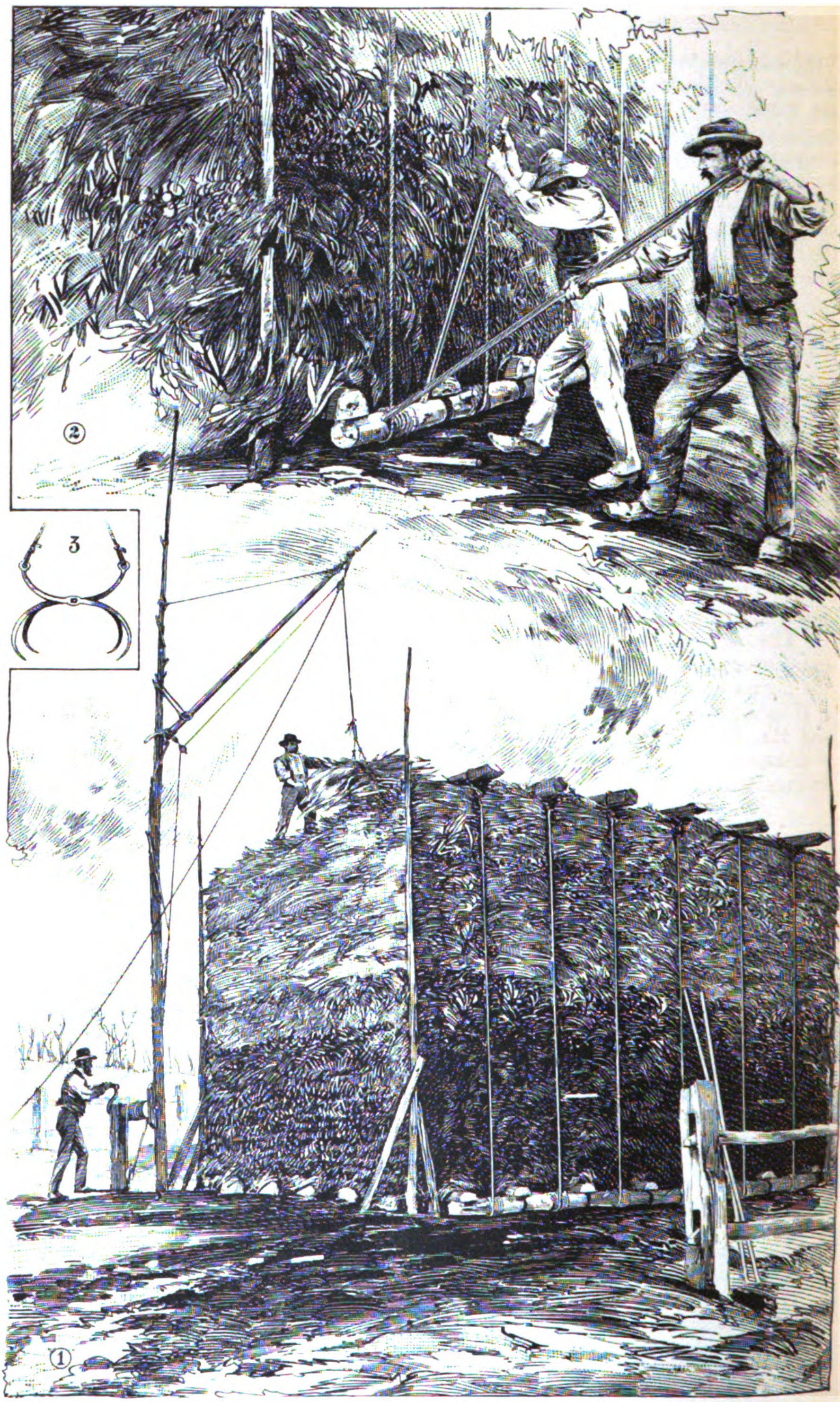
logs lifting when the pressure is put on. From a box, iron-bark, or other tough sapling, say 6 inches through, cut twelve rollers 3 feet long, adzing the ends down to circle marked by compass. Bore with 1¼ auger two holes through each end, the outside ones to clear bottom logs, when placed under ends, the others at right angles to the first, but clear of the first set of holes—an auger hole in each roller to carry end of wire rope to grip on roller. At one corner of stack erect a sapling (say) 20 feet out of the ground, to which connect a gaff 10 feet long, with iron jaw to fit round mast, as shown in sketch—so allowing the stuff to be hoisted on to stack from one end and one side if necessary.

"At foot of mast construct a winch as shown, fixing block below the drum, so as to have the strain downwards when hoisting. Obtain one iron jaw, on the principle of those used by contractors to lift heavy stones, with each arm divided below the connecting bolt into two teeth, a foot apart at the points. Affix a block at end and one at foot of gaff, and one below drum of windlass—run a strong rope through these blocks, connect with windlass, and fasten the lifting jaw on to the other end.

"For distributing the pressure evenly on the stuff after stacking, get six dead logs 16 feet long x 8 inches diameter, and bore 1-inch auger hole through each end about 15 feet apart; twelve wire-ropes (gal.) the height your stack will be, allowing for one turn round end of top log. The top logs are placed directly over the centre of the rollers between the foundation logs, and the tightening is by means of levers as shown on the plate. The pressure is secured by means of pieces (about 18 inches long) of gas-piping which pass through the rollers and catch in a small sapling which is fixed under the bottom logs. Now, for a fair estimate of the cost of this seemingly complicated arrangement. It will cost about £2 13s. to get, dress logs, and erect mast and windlass, and cut rollers and bore them. Three single blocks (say) 15s.; jaw for mast and one for lifting, 15s.; rope, hemp, 10s.; wire ropes (1½ inch circumference), £2 10s.; two iron bars, 9 feet x 1¼, £1 5s., making a total of £7 15s. for a plant that will last for, say, seven years, although the only portion requiring renewing at all will be the timber and hemp rope.

"The cost per ton of the silage is rather more difficult to get at, but, taking a fair crop of corn to cut 20 tons per acre, it will not cost more than 6s. 6d. per ton when ready to feed to the cows. Ploughing and harrowing 1 acre twice, say, 30s.; scarifying three times, 9s.; drilling and harrowing in, 4s.; seed (1 bushel), 5s.; cutting, 12s.; carting, 36s.; stacking, 30s. Total, 126s. Thus making the 20 tons cost £6 6s., or say, 6s. 6d. per ton. This estimate is a high one, for it allows three men for carting and loading two drays (tip), *i.e.*, two always loading and one driving—it allows for two men and a boy at the stack, and gives two days to put together 20 tons, which is less than could be done were the stuff grown close to the stack, for this estimate is based on work done with drawing nearly half a mile.

"The corn being cut with a cane-knife is all laid one way in heaps convenient to the cutter, allowing width enough between the rows of heaps for the carts to pass, the body of dray is filled with the butts of the stuff up to front board. When level with the side rails the bundles are placed crosswise, tops and bottoms alternately, and, by thus loading, as much as 1½ tons can be put upon a small-sized dray. This is taken to the stack and tipped, and comes out as placed in without being tangled and twisted together. Each armful can be easily separated and the jaws of the iron lifter placed round it. When hoisted on the stack it is carefully placed, always keeping the outsides of the stack higher than the middle, because the latter is more solid from the



MR. THROSBY'S ENSILAGE STACK.

treading than the former. When the stack has been raised to 8 or 10 feet, the logs should be placed on the top, and a constant pressure be given for, say, three days, to consolidate the mass and prevent the temperature from rising too much. A simple way of getting at the temperature is to lay a ¾-inch gas-pipe slightly inclined, reaching about half-way across the stack and build it in with the corn. By connecting a thermometer (graduated to read up to a temperature of, say, 200 degrees) to a piece of wire it can be pushed down the pipe, the end of which is then corked up and after a few seconds the thermometer may be taken out and read. With corn it will reach sometimes 150 degrees, but ordinarly about 140 degrees is the limit.

"An advantage gained by having the pressure square on the top is that when stacking is again commenced, you have a square foundation, and not rounded as when ropes over the top have been used.

"The sides and ends should be kept plump and cut neatly with a hay-knife. It is a very good plan to put up permanent posts at the four corners, the mast being one.

"When the whole of the stuff is stacked, it is advisable to place a piece of scantling or sapling along the edge at each end, and short pieces from underneath the first and last top logs on to it, thus securing an even pressure along those edges. The end logs do not press as close to the outside as is necessary, in fact, some trouble taken to place pieces with their ends under each log at intervals would be well repaid by distributing the pressure evenly over the whole surface, and they can be taken out as each section nearly up to a top log is cut out for feeding.

"The covering can be done as approved by the owner, but sheets of roofing iron forming a simple slanting roof with a fall of about a foot, will answer the purpose and the sheets of iron can be removed as required."

It is satisfactory to be able to add that the stack described has been cut, and Mr. Throsby is much pleased with the result. There was not more than 3 inches of waste on top, and about 6 inches on the sides. The silage was in excellent, juicy condition, and much relished by the cows.

Reference to Plate.—A, general view of stack; B, process of increasing pressure; C, the "Gripper" or "Jaws."

Paying for Milk by Results.

Some of the leading factory managers in Victoria have been communicating their experience with regard to paying for milk by results to the "Australian Farm and Home," and we lay their views before the large number of dairy-farmers, and managers, and directors of factories in New South Wales who are deeply interested in this new principle.

Mr. R. Crowe, manager of the Koroit Butter Factory gives some excellent figures to show how some suppliers to an ordinary factory lose when paid a fixed price per gallon for the milk, and others gain, or rather get their just dues, when paid by the results in butter-fat. He takes as an example, a factory where 15 per cent. of the suppliers supply 10 per cent. of the total amount of milk treated, which gives an average of 3·5 per cent. of butter-fat —worth 3½d. a gallon. When paid by results these men get only £1,050 for their supply of milk, while if paid at an even rate they would receive £1,200, or £150 at the expense of the better class of suppliers. Twenty-five per cent. of the suppliers who supply 25 per cent. of the total quantity of milk, giving 3·6 per cent. butter-fat, when paid at the rate of 3¾d. a gallon draw £2,812 10s.; whereas if paid at a uniform rate they would get £3,000—that is, £187 10s. at the cost of the better suppliers. Twenty per cent. of the suppliers who supply 30 per cent. of the milk with an average of 3·8 per cent. butter-fat, get exactly their just due. Twenty-five per cent. of the suppliers who supply a quarter of the total milk with 3·95 per cent. of butter-fat, gain £187 10s. by the adoption of the principle of payment by results; and 15 per cent. of the suppliers who supply 10 per cent. of the total milk with an average of 4·1 per cent. of butter-fat, gain £150, or an average of £10 each by getting their just dues.

Mr. Crowe's experience bears out that of many other intelligent dairy-farmers that the class of cows kept has more to do with the quality of the milk than the food given them, and he quotes an instance of two farmers who had very different breeds of cows, but whose pasture and methods of feeding were exactly the same, and yet one had been sending in the poorest milk and the other the richest. He gives other figures to show the results from individual cows belonging to one farmer who supplied milk of the average quality, and shows that if all the eight cows which gave milk below the standard value—3·6 per cent. butter-fat—were eliminated from this herd, the percentage of butter-fat would be raised from 3·87 to 4·19 per cent., which would mean a pound of butter more for every 30 gallons of milk supplied, and which would raise the average price of his milk nearly a halfpenny a gallon.

The following table shows the comparison between the two systems, and we quote as an example a factory of average size, doing an average business, with 100 suppliers, paying £12,000 per year for 720,000 gallons of milk:—

Per cent. of Suppliers.	Per cent. of Supply.	Per cent. Fat.	Price by Results.				Price by even payment.			
			d.	£	s.	d.	d.	£	s.	d.
15	10	3·5	3½	1,050	0	0	4	1,200	0	0
25	25	3·65	3¾	2,812	10	0	4	3,000	0	0
20	30	3·8	4	3,600	0	0	4	3,600	0	0
25	25	3·95	4¼	3,187	10	0	4	3,000	0	0
15	10	4·1	4½	1,350	0	0	4	1,200	0	0
100	100	3·8	4	12,000	0	0	4	12,000	0	0

Mr. A. W. Hassall, manager of the Benjordan factory, reports that he has been using the Babcock tester for six months, and although he has found variations owing to different reasons such as the introduction of a few Alderney cows into the herd, or a change of milkers, or any other satisfactory reason, on the whole he has found this system gives thorough satisfaction to all the suppliers. He prefers, instead of paying for the milk at the rate fluctuating with the price of butter, to calculate the total percentage of butter-fat supplied by any one dairy-farmer and to pay for that according to the ruling rate of butter, retaining a safe margin for expenses, wear and tear, &c. He is adopting the system of taking a sample every day and making a test of it once in three days.

Mr. A. G. Rowe, manager of the Kyneton butter factory, expresses his satisfaction with the general system of paying by results. He finds that when the weather is very cold it is impossible to get a fair test from cold milk, and therefore always uses a steam jet to heat each supplier's milk to a temperature not exceeding 75 degrees Fahr., when he finds that he can get the same percentage of butter-fat from the night's milk as he gets from the morning's. He has found that the actual yield of butter is always slightly in excess of that computed from the figures shown on the Babcock tester, but they are always close enough for all practical purposes. He found the average percentage of fat in the largest number of samples was 3·5 per cent. and that it took 2½ gallons of such milk to make a pound of butter.

Messrs. Cherry and Sons, who have taken a deal of trouble to introduce the Babcock tester into Victoria, strongly advocate paying for the butter not for the milk, giving an example of a man who supplies 40 gallons of milk showing 4·25 per cent. of butter-fat, who should thus be paid for 17 lb. of butter at 1s. a lb. or the current market rate. If a farmer wished to know what he was getting per gallon for his milk, he would find it at once by dividing 17s. by 40 gallons, which would give him 5$\frac{1}{10}$d. per gallon.

Mr. C. C. Lance, the secretary of the Euroa butter factory, has taken special interest in this question, and his experience is particularly valuable. He has adopted the system which we have previously described of taking a sample through a tiny hole in the middle of a pipe which conveys the milk from a tank in which it has been thoroughly mixed into another tank from which it runs into the separator. He takes a small sample of each supplier's milk every day, places it into a bottle labelled with the supplier's name, and at the end of the week takes a fair sample of the mixture. He finds that boric acid is the very best preservative for keeping the milk sweet.

He has adopted 3d. per gallon as the standard value for milk yielding 3·6 per cent., butter-fat, giving 3$\frac{3}{16}$d. for milk with 3·8 per cent., 3$\frac{4}{16}$d. for 4 per cent., milk,and so on, the average price coming out 3$\frac{6}{32}$d., which is equivalent to 24 lb. of milk to 1 lb. of butter.

The churn test shows 23·7 lb. to 1 lb. of butter, giving a slight advantage in favour of the churn.

Mr. Lance thinks it not unlikely that eventually his company will pay the suppliers for their total yield of butter ; although meanwhile they find the system of paying for the milk simple and accurate enough.

Mr. D. W. Taylor, Manager of the Fresh Food and Frozen Storage Company, uses the Weigel milk tester and has found it wonderfully correct. On numerous occasions the Company's Inspector has reported in advance the quantity of butter a given quantity of milk should yield, and when the cream was churned at the factory in Melbourne, the results from the churn always coincided exactly with the records of the Weigel tester. Their standard for pure milk is 9 per cent. as indicated by this tester, which has been invented by Mr. Max Pincus, of Victoria.

The Department of Agriculture has taken steps to secure one of these machines on trial and will compare it under strict conditions with the Babcock, and, if possible, with Laval's Butryometer and a churn, and publish full details as to cost, method of working, accuracy of results, &c. Mr. Taylor mentions that the practice of testing for quality has had the effect of greatly improving the quality of the milk supplied, the average number of pounds of milk required for a pound of butter being now much lower than previous to the appointment of their inspector.

We trust that before long every factory in New South Wales will have adopted the principle of paying by results so that the greatest possible encouragement may be given to those dairymen who have spent years in improving the character of their herds, and have always aimed at quality instead of quantity of milk. When it becomes clearly understood that the men whose cows give milk yielding 5 per cent. butter-fat get paid 2d. a gallon for their milk more than those whose cows only yield 3 per cent. the latter class of dairymen will consider how they can best improve the breed of their cattle in the first place, and keep them up to the proper standard by means of judicious feeding during the trying months of the year, whether in mid-winter or mid-summer.

We note that at the half-yearly Convention of the Dairyman's Association of Victoria, held in Melbourne, April 6th, after hearing the experience of the Factory Managers who had tried the system of paying by results,—whether by means of the Babcock Tester, the De Laval's Butryometer, or Weigel's machine—the meeting expressed the opinion "that the introduction of testers, chiefly the Babcock, has resulted in a vast improvement in the character of the milk supplied, and the knowledge that tests were being used was sufficient to keep suppliers up to the mark," and a resolution was carried that "the Convention can confidently recommend the system to all factories as the only just method of purchasing milk."

The Increase of Fluke in Sheep.

By P. L. SMITH,
Inspector of Stock.

THERE is no denying the fact that fluke in sheep has increased in many parts of New South Wales to an alarming extent during the past three years. Many owners who have been drenching with all the known remedies for the cure of lung, stomach, and tape-worms, which, in years gone by, used to give satisfactory results in most cases, find this year that, notwithstanding their persistant drenching, their sheep continue to die; it is very hard to convince some of them that it is not a poison plant which is causing the deaths of their sheep. However, the majority of owners in my district are now beginning to realise that fluke has more to do with the losses than all the other worms; and in writing this article, I have no other desire than to arouse owners to a sense of the danger which exists, and to induce practical stock-owners to give publicity to their ideas on this most important question, with the view to get at the best method of checking the evil. My opinions are given for what they are worth, but they are based on close observation, and I hope they will at least be worth the consideration of practical sheep-owners, who are invited to prove them wrong, and suggest a better course of action.

The cause of the increase of Fluke.

The cause of the increase of fluke, as well as other parasites infesting the stomachs of sheep, is in my opinion traceable to over-stocking, induced by indiscriminate ringbarking, and materially assisted by a succession of wet seasons. I think everyone will admit that stock of all kinds, and more particularly sheep, have increased to an enormous extent within the last twenty-five years. Prior to that period very few internal diseases were known among sheep in Australia, for the simple reason that the Almighty, in His wisdom, provided all animals with medicinal and saline herbs, and the instinct when to take them. The result of over-stocking has been to clear the pastures of the Colony of all their saline and medicinal herbs, and no equal to them in the way of artificial sustitutes has ever been discovered in the limited wisdom of man. Even if there had, the effect would not be the same, because the instinct of the animal taught it to take the medicine provided by nature at exactly the correct time, and in the correct quantity necessary to preserve it in health.

I will now try and show why one of the effects of over-stocking has been the increase of fluke, and why one of the effects of indiscriminate ring-barking, has been the inducement to, and thereby the cause of over-stocking. I will do this briefly as I will probably go more fully into the matter of ringbarking in another paper. Ringbarking, without a doubt, doubled the carrying capabilities of the land, and the stock-owners in a great many instances trebled the number of their stock. That is my opinion, shortly put.

Since the rough copy of this article was written, I have come across an article in print (evidently written by a practical man) headed "Sheep Sick Lands," in which he says, "That the statement that has been made that the lands of Australia, taken as a whole, are becoming sheep-sick, is true in every respect." I quite agree with him. On the effects of over-stocking, further on in the same paper, he says:—"Any agriculturist, vinegrower, or tiller of the soil, who would crop his land for fifty, eighty, or a hundred years, and crop it heavily, would be considered mad if he never gave it a 'rest' or assisted it with artificial manure." And in my opinion he is right, yet this is how a large percentage of the New South Wales pastoralists are acting. They are cropping their land so heavily with sheep that the pasture is poisoned with germs detrimental, and in many cases fatal, to the lives of sheep, amongst which are the fluke ova. The droppings of the sheep, on all these overstocked holdings, contain, or have adhering to them, the germs of fluke. These are communicated to the pasture and from the pasture, through heavy rains, to the tanks, dams, and water-courses, the result of which is that the sheep on such holdings, can no longer get a mouthful of grass or water without swallowing the germs of disease. Many practical sheep-owners are now of opinion that the water-courses are the great source of fluke, while other equally practicable men express an opposite opinion. I do not know which are right or which are wrong, I only know that fluke is increasing.

Many years ago in Victoria the popular democratic cry was "Bust (*sic*) up the large estates." My idea is that the pastoralists have only to pile on the agony for a few years longer, in the shape of over-stocking, when not only will the large estates, but the small also, be burst up, for they will become so sheep sick, that they will not be able to grow sheep on them, and will have to be let or used for agricultural purposes.

The Remedies.

Now as to the remedies for the cure of fluke. I have had, less a few months, forty years practical experience among sheep, but I was never able to recommend a cure for fluke, if sheep had the disease properly, except to get rid of all that were fit for the butcher and boil the rest down for their tallow.

My idea is that the cause wants removing, which means time and money. The evil after-effects of ringbarking must be got rid of, *i.e.*, fallen timber, bark, and other rubbish, the harbour of parasites and the cover of land, which should be covered instead with sweet pasture. Surface draining every acre of land where water lodges. Systematic and gradual burning off all rough coarse pasture. I am aware that some owners in my district do not believe in burning pasture at all, but, I think, they are in the minority, and I am convinced by practical proof that when judiciously done it is good.

I fancy I hear some stockowners say, "can't be done," "too expensive," and so on, and quote the old adage, "While the grass grows the stud starves,"—but in the meantime drenching must in most cases be resorted to, for unfortunately, in too many instances, stomach, tape and sometimes lung worms worry the sheep when he is suffering from fluke. I believe more in licks for prevention than drenches for cure, and I am constantly trying to find out and recommend the best. To Mr. F. R. C. Hopkins, the Chairman of the Carcoar Sheep and Pasture Board, and the editor of the "Animal Parasites in Sheep," is due the credit of having discovered the best (at date) palliative tonic known for fluke, and he has been kind enough to allow me to

have it published for general information. It possesses one great recommendation that I find wanting in some "licks," the ingredients are not hidden mysteries. Some years ago this gentleman, struck by the fact that a mixture of gentian, ginger, and sulphate of iron had been used in England in small doses for sheep that had suffered severely from lung worms, decided to try the combination as a "lick" in open troughs (protected from the rain) and mixed with nine or ten times the weight of Liverpool, German, or Adelaide salt.* The results, Mr. Hopkins assures me, have proved most satisfactory, but it is not for a moment to be believed, that this or indeed any lick will absolutely prevent the parasite.

The cost of the lick, exclusive of salt, is about £40 per ton, and it is said to be money well expended where fluke is known to exist. Nothing better can be recommended to sheep-owners, and its efficacy can easily be tried and ascertained.

NOTE.—It seems very probable that an analysis of the food of sheep from a fluke-stricken run may disclose reasons for the prevalence of this disease which are at present unsuspected.—W.S.C.

* Example,—10 lb. gentian, 10 lb. ginger, and 10 lb. sulphate of iron all mixed together, to which is added either 270 lb. or 300 lb. of pounded salt.

Analyses of Soils.

By F. B. GUTHRIE.
With Notes by Mr. H. C. L. Anderson.

Myall River, Port Stephens.

The nature of the soil is light sandy loam; the reaction of the soil is neutral; and its capacity for water, 30 per cent.; absolute weight per acre, 6 inches deep, 3,226,482 lb.

A mechanical analysis of this soil shows that it contains root-fibres 0 per cent.; stones over ¼ inch in diameter, 0 per cent.; coarse gravel, more than $\frac{1}{10}$-inch diameter, ·20 per cent.; fine gravel, more than $\frac{1}{30}$-inch diameter, 2·18 per cent.; fine soil, 97·62 per cent., comprising sand, 77·91 per cent., and impalpable matter, chiefly clay, 19·71 per cent.

An analysis of the fine soil discloses moisture, ·836 per cent., and volatile and combustible matter, principally organic, 1·998 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of:—Lime (CaO), ·042 per cent., the general value of which is bad, being equivalent to 1,344 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·010 per cent., the general value of which is bad, being equivalent to 320 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·052 per cent., the general value of which is fair, being equivalent to 1,664 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·061 per cent. (equal to ·074 per cent. of ammonia), the general value of which is fair, being equivalent to 1,952 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·085 per cent., the general value of which is fair; ferric oxide (Fe_2O_3), ·326 per cent., general value, deficient; and sulphuric acid (SO_3), ·007 per cent., general value, deficient; ferrous oxide, .072 per cent.

In connection with the foregoing particulars, the special points of value in the soil are nil, its special defects, lime, potash, phosphoric acid, iron, and sulphuric acid. Its general character mechanically is very fair, and chemically, very bad. There are no farm crops for which it is suitable, without heavy manuring.

It is hardly possible it can pay to manure such a soil in such a district, as complete plant food would have to be put into the soil before it could be got

Note.—(*a*) This amount of lime would be supplied in 1,493 lb. of quicklime, or 2,016 lb. of slaked lime, or 2,611 lb. of chalk. (*b*) This amount of potash would be supplied in 640 lb. of commercial sulphate of potash, or 2,665 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 6,656 lb. of commercial bone-dust, or 9,984 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 9,760 lb of sulphate of ammonia, or 11,712 lb. of nitrate of soda.

out again in the form of crops. Any manure should be a complete one containing high percentages of potash, phosphate of lime, and nitrogen, such as Colonial Sugar Coy's. No. 5, or Gee's P. B. B. containing 10 per cent. of potash. If bone dust or fish refuse be used it must be enriched with a large percentage of potash. It was recommended that a small experiment be made with one of these manures on a small plot of maize and potatoes to decide commercial results.

Raymond Terrace.

The nature of the soil is light sandy loam; the reaction of the soil is neutral, and its capacity for water, 33·33 per cent; absolute weight per acre, 6 inches deep, 3,122,380 lb.

A mechanical analysis of this soil shows that it contains of root-fibres, ·25 per cent; stones over ¼ inch in diameter, 1·41 per cent.; coarse gravel, more than $\frac{1}{10}$-inch diameter, 1·64 per cent.; fine gravel, more than $\frac{1}{50}$-inch diameter, 25·47 per cent.; fine soil, 71·23 per cent., comprising sand, 52·25 per cent., and impalpable matter, chiefly clay, 18·98 per cent.

An analysis of the fine soil discloses of moisture, ·704 per cent., and volatile and combustible matter, principally organic, 2·639 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of:—Lime (CaO), 0·84 per cent., the general value of which is fair, being equivalent to 2,604 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·069 per cent., the general value of which is fair, being equivalent to 2,139 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), 060 per cent., the general value of which is fair, being equivalent to 1,860 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·089 per cent. (equal to ·109 per cent. of ammonia), the general value of which is satisfactory, being equivalent to 2,759 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·067 per cent., general value of which is indifferent; ferric oxide (Fe_2O_3), ·443 per cent., general value deficient; and sulphuric acid (SO_3), ·019 per cent., general value deficient; ferrous oxide, ·112 per cent.

In connection with the foregoing particulars, the special points of value in the soil are nil, and its special defects, phosphoric acid, lime, organic matter. Its general character mechanically is very fair, and chemically, poor. It is unsuitable, without special manure or special treatment, for heavy crops,—cereals, hay, sorghum, maize. The manures used should be complete ones containing a fair percentage of potash, nitrogen, lime, and phosphoric acid; such as Sugar Co.'s No. 3 (4 cwt. per acre in spring), or Gee's P.B.B. fertiliser (4 cwt. per acre in autumn).

Speaking generally, if genuine bone-dust can be got locally, a first-class manure can be made with five parts of bone-dust, four of dried blood, and one of sulphate of potash. Of course all available farm-yard manure should be utilised as much as possible, and those mentioned above used as supplementary to it.

Note.—(*a*) This amount of lime would be supplied in 2,893 lb. of quicklime, or 3,906 lb. of slaked lime, or 5,208 lb. of chalk. (*b*) This amount of potash would be supplied in 4,278 lb. of commercial sulphate of potash, or 17,817 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 7,440 lb. of commercial bone-dust, or 11,160 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 13,795 lb. of sulphate of ammonia, or 16,554 lb. of nitrate of soda.

Numba, Shoalhaven River.

From a Swamp recently drained.

The nature of the soil is clay loam ; the reaction of the soil is neutral ; and its capacity for water, 67·5 per cent ; absolute weight per acre, 6 inches deep, 1,765,284 lb.

A mechanical analysis of this soil shows that it contains of root-fibres, ·58 per cent. ; stones over ¼ inch in diameter, none ; coarse gravel, more than $\frac{1}{10}$-inch diameter, none ; fine gravel, more than $\frac{1}{30}$-inch diameter, none ; fine soil, 99·42 per cent., comprising sand, 35·77 per cent., and impalpable matter, chiefly clay, 63·65 per cent.

An analysis of the fine soil discloses moisture, 4·232 per cent., and volatile and combustible matter, principally organic, 10·203 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of :—Lime (CaO), ·306 per cent., the general value of which is good, being equivalent to 5,202 lb. (*a*) in an acre of soil 6 inches deep ; potash (K_2O), ·411 per cent., the general value of which is good, being equivalent to 6,987 lb. (*b*) in an acre of soil 6 inches deep ; phosphoric acid (P_2O_5), ·264 per cent., the general value of which is good, being equivalent to 4,488 lb. (*c*) in an acre of soil 6 inches deep ; nitrogen, ·257 per cent. (equal to ·318 per cent. of ammonia), the general value of which is good, being equivalent to 4,367 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·282 per cent., general value of which is satisfactory ; ferric oxide (Fe_2O_3), 1·716 per cent., general value satisfactory ; ferrous oxide, 1·008, general value deleterious ; and sulphuric acid (SO_3), ·331 per cent., general value good ; chlorine, 1,114 = 1·838 common salt.

In connection with the foregoing particulars, the special points of value in the soil are potash, phosphoric acid, and nitrogenous matter ; its special defects, common salt and ferrous oxide (black oxide of iron) and stiff character. Its general character mechanically is fair, and chemically, good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are maize, greenstuff, cabbages, vines, summer fruit, peas, beans, asparagus, and mangolds ; while it is unsuitable, without special manure or special treatment, for potatoes or wheat. The manures and treatment recommended for trial are fallowing as long as possible to allow air to turn black oxide into red oxide of iron, to burst up the clay, and to let the rain in to wash out the salt. Lime—1 ton per acre—to further burst up the clay and liberate the latent potash, as well as sweeten the soil after its long stagnation. Speaking generally, the percentage of salt is, at present, injurious, but will rapidly diminish through the action of the drains, into which the rain will gradually wash this substance. Otherwise the soil is rich, and should need no manure for some years. Dried blood might be worth trying for heavy crops of greenstuff.

Note.—(*a*) This amount of lime would be supplied in 5,780 lb. of quicklime, or 7,903 lb. of slaked lime, or 10,404 lb. of chalk. (*b*) This amount of potash would be supplied in 13,974 lb. of commercial sulphate of potash, or 58,201 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 17,952 lb. of commercial bone-dust, or 26,928 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 21,845 lb. of sulphate of ammonia, or 26,214 lb. of nitrate of soda.

GOULBURN.

THE nature of the soil is light sandy loam; the reaction of the soil is neutral; and its capacity for water 29 per cent. Absolute weight per acre, 6 inches deep, 3,233,238 lb.

A mechanical analysis of this soil shows that it contains of root-fibres, ·12 per cent.; stones over ½-inch in diameter, nil; coarse gravel, more than $\frac{1}{10}$-inch diameter, ·35 per cent.; fine gravel, more than $\frac{1}{40}$-inch diameter, 1·56 per cent.; fine soil, 97·97 per cent., comprising sand, 75·16 per cent., and impalpable matter, chiefly clay, 22·81 per cent.

An analysis of the fine soil discloses moisture, ·062 per cent., and volatile and combustible matter, principally organic, 2·081 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·167 per cent., the general value of which is satisfactory, being equivalent to 5,364 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·056 per cent, the general value of which is fair, being equivalent to 1,792 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·018 per cent., the general value of which is bad, being equivalent to 576 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·092 per cent. (equal to ·112 per cent. of ammonia), the general value of which is satisfactory, being equivalent to 2,944 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·090 per cent., general value of which is fair; ferric oxide (Fe_2O_3), ·488 per cent., general value, deficient; ferrous oxide ·144 per cent., and sulphuric acid (SO_3), ·045 per cent., general value, satisfactory.

In connection with the foregoing particulars, the special point of value in the soil is its mechanical condition, and its special defect, phosphoric acid. Its general character mechanically is very good, and chemically, uneven and deficient. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are fruit and vegetables, with manure, while it is unsuitable, without special manure or special treatment, for cereals.

Complete manures should be used, stable manure, nightsoil, and offal being very useful, if available. The best artificial manures would be Sugar Company's No. 3, or a mixture of good bone-dust or dried blood, with 5 per cent. potash, such as Gee's P.B.B. No. 2. manure.

Speaking generally, good bone-dust alone will answer for fruit and vegetables for a time, but will gradually lose its virtue without potash, the supply of which in the soil is not sufficient for many heavy crops. If good bone-dust is available locally, the dried blood and potash can be got from Sydney, and the whole mixed in the proportion of 10 cwt. bone-dust, 8 cwt. dried blood, 2 cwt. sulphate of potash; 2 lb. of the mixture per tree for each year in age.

NOTE.—(*a*) This amount of lime would be supplied in 5,937 lb. of quicklime, or 7,845 lb. of slaked lime, or 10,601 lb. of chalk. (*b*) This amount of potash would be supplied in 3,317 lb. of commercial sulphate of potash, or 12,800 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 907 lb. of commercial bone-dust, or 685 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 14,720 lb. of sulphate of ammonia, or 17,664 lb. of nitrate of soda.

Liverpool.

The nature of the soil is sandy loam; the reaction of the soil is neutral; and its capacity for water, 37 per cent; absolute weight per acre, 6 inches deep, 3,346,889 lb.

A mechanical analysis of this soil shows that it contains of root-fibres, nil; stones over $\frac{1}{4}$ inch in diameter, nil; coarse gravel, more than $\frac{1}{10}$-inch diameter, nil; fine gravel, more than $\frac{1}{30}$-inch diameter, 3·37 per cent.; fine soil, 96·63 per cent.,—comprising sand, 65·68 per cent., and impalpable matter, chiefly clay, 30·95 per cent.

An analysis of the fine soil discloses moisture, 1·138 per cent., and volatile and combustible matter, principally organic, 3·649 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·143 per cent., the general value of which is satisfactory, being equivalent to 4,719 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·083 per cent., the general value of which is satisfactory, being equivalent to 2,739 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·182 per cent., the general value of which is good, being equivalent to 6,006 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·073 per cent. (equal to ·088 per cent. of ammonia), the general value of which is fair, being equivalent to 2,409lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·163 per cent., general value of which is satisfactory; ferric oxide (Fe_2O_3), 1·390 per cent., general value, deficient; ferrous oxide ·280 and sulphuric acid (SO_3), ·026 per cent.; general value, satisfactory.

In connection with the foregoing particulars, the special points of value in the soil are phosphoric acid and mechanical condition, and defects, nitrogenous matter, capacity for water. Its general character mechanically is very good, and chemically, fair. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are summer and citrus fruit, roots, and greenstuff, while it is unsuitable, without special manure or special treatment, for heavy crops of cereals. The manures and treatment recommended for trial are dried blood (3 cwt. per acre), or sulphate of ammonia ($1\frac{1}{2}$ cwt.) would probably give good results for a few years; but it would be better to supplement the nitrogenous manure with a little superphosphate of lime and potash. Speaking generally, for fruit, hay, grass, and potatoes I should recommend Sugar Company's No. 3 manure in spring, or a mixture of 5 parts dried blood, 4 bone-dust, and 1 sulphate of ammonia; green manuring with lupines, peas, vetches, or clover would improve the soil mechanically and chemically, especially for fruit-trees of all kinds.

Note.—(*a*) This amount of lime would be supplied in 5,243 lb. of quicklime, or 7,078 lb. of slaked lime, or 9,438 lb. of chalk. (*b*) This amount of potash would be supplied in 5,478 lb. of commercial sulphate of potash, or 22,815 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 24,024 lb. of commercial bone-dust, or 36,036 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 12,045 lb. of sulphate of ammonia, or 14,454 lb. of nitrate of soda.

CLIFTON.

THE nature of the soil is light sandy loam; the reaction of the soil is neutral; and its capacity for water, 72·5 per cent. Absolute weight per acre, 6 inches deep, 1,428,550 lb.

A mechanical analysis of this soil shows that it contains of root-fibres, 5·08 per cent.; stones over ¼ inch in diameter, none; coarse gravel, more than $\frac{1}{10}$ inch diameter, ·54 per cent.; fine gravel, more than $\frac{1}{50}$ inch diameter, 4·81 per cent.; fine soil, 89·57 per cent., comprising sand, 71·64 per cent., and impalpable matter, chiefly clay, 17·93 per cent.

An analysis of the fine soil discloses moisture, 4·729 per cent., and volatile and combustible matter, principally organic, 14·121 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·053 per cent., the general value of which is indifferent, being equivalent to 742 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·090 per cent., the general value of which is satisfactory, being equivalent to 1,260 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·197 per cent., the general value of which is good, being equivalent to 2,506 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·246 per cent. (equal to ·299 per cent of ammonia), the general value of which is good, being equivalent to 3,444 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·127 per cent., general value of which is satisfactory; ferric oxide (Fe_2O_3), ·202 per cent., general value satisfactory; ferrous oxide, 1·568, deleterious; and sulphuric acid (SO_3), ·038 percent., general value satisfactory.

In connection with the foregoing particulars, the special points of value in the soil are organic matter, phosphoric acid and power of retaining moisture, and its special defects lime and excess of black oxide of iron. Its general character mechanically is very good, and chemically, very fair. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are vegetables, maize, sorghum, greenstuff; while it is unsuitable, without special manure or special treatment, for fruit-trees. The manures and treatment recommended for trial are—1. Sub-drainage is absolutely essential; 2. Deep cultivation to get rid of the deleterious black oxide, and convert it into red oxide of iron (rust);. 3. Dressing of 1 ton lime per acre in autumn to decompose vegetable matter

Speaking generally, the most useful manures after the lime would probably be 2 cwt. kainit and 2 cwt. bone-dust, or 3 cwt. Sugar Company's. No. 6 manure per acre. With proper treatment the soil ought to give satisfactory results. Keep the soil constantly open to the sweetening influence of the air.

NOTE.—(*a*) This amount of lime would be supplied in 824 lb. of quicklime, or 1,113 lb. of slaked lime, or 1,484 lb. of chalk. (*b*) This amount of potash would be supplied in 2,520 lb. of commercial sulphate of potash, or 10,495 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 10,024 lb. of commercial bone-dust, or 15,036 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 17,220 lb. of sulphate of ammonia, or 20,664 lb. of nitrate of soda.

Christmas Creek, Macleay River.

The nature of the soil is sandy loam; the reaction of the soil is neutral; and its capacity for water, 50·66 per cent. Absolute weight per acre, 6 inches deep, 2,310,169 lb.

A mechanical analysis of this soil shows that it contains of root-fibres, ·27 per cent.; stones over ¼ inch in diameter, 7·00 per cent.; coarse gravel, more than $\frac{1}{10}$-inch diameter, 5·72 per cent.; fine gravel, more than $\frac{1}{30}$-inch diameter, 3·41 per cent.; fine soil, 83·60 per cent., comprising sand, 55·64 per cent., and impalpable matter, chiefly clay, 27·96 per cent.

An analysis of the fine soil discloses moisture, 6·929 per cent., and volatile and combustible matter, principally organic, 14·465 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·294 per cent., the general value of which is good, being equivalent to 6,762 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·091 per cent., the general value of which is satisfactory, being equivalent to 2,093 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·366 per cent., the general value of which is good, being equivalent to 8,418 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·173 per cent. (equal to ·211 per cent. of ammonia), the general value of which is good, being equivalent to 3,979 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·690, general value of which is very good; ferric oxide (Fe_2O_3), 8·299 per cent., general value satisfactory; ferrous oxide, 2·446 and sulphuric acid (SO_3), ·025 per cent., general value satisfactory.

In connection with the foregoing particulars, the special point of value in the soil is phosphoric acid, and its special defect, ferrous oxide—the deleterious black oxide of iron. Its general character mechanically is good, and chemically, good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are, with proper treatment, any crops suited to climate, while it is unsuitable, without special manure or special treatment, for none in particular. The manures and treatment recommended for trial are opening up to the air as much as possible to let the oxygen turn the black oxide of iron into the red oxide (rust). For potatoes, vines, fruit-trees, and maize, kainit would probably be a very useful manure. Speaking generally, I should recommend a dressing with lime—1 ton per acre—at once; to be followed in spring with 3 cwt. kainit and 1½ cwt. dried blood per acre, for roots and maize.

Note.—(*a*) This amount of lime would be supplied in 7,513 lb. of quicklime, or 10,143 lb. of slaked lime, or 13,524 lb. of chalk. (*b*) This amount of potash would be supplied in 4,186 lb. of commercial sulphate of potash, or 17,434 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 33,372 lb. of commercial bone-dust, or 50,508 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 19,895 lb. of sulphate of ammonia, or 23,874 lb. of nitrate of soda.

BULLAHDELAH.

THE nature of the soil is clay loam; the reaction of the soil is neutral; and its capacity for water, 37·33 per cent.; absolute weight per acre, 6 inches deep, 2,231,143 lb.

A mechanical analysis of this soil shows that it contains no root-fibres; stones over ¼ inch in diameter, nil.; coarse gravel, more than $\frac{1}{10}$-inch diameter, chiefly charcoal, 1·25 per cent.; fine gravel, more than $\frac{1}{50}$-inch diameter, 1·35 per cent.; fine soil, 97·40 per cent., comprising sand, 28·20 per cent., and impalpable matter, chiefly clay, 69·20 per cent.

An analysis of the fine soil discloses moisture, 1·497 per cent., and volatile and combustible matter, principally organic, 4·214 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·084 per cent., the general value of which is fair, being equivalent to 1,848 lb. (*a*) in an acre of soil 6 inches deep; potash (K_2O), ·068 per cent., the general value of which is fair, being equivalent to 1,496 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid (P_2O_5), ·037 per cent., the general value of which is indifferent, being equivalent to 814 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·112 per cent. (equal to ·136 per cent. of ammonia), the general value of which is satisfactory, being equivalent to 2,464 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·102, general value of which is satisfactory; ferric oxide (Fe_2O_3), ·331 per cent., general value deficient; ferrous oxide, ·432 per cent., and sulphuric acid (SO_3), ·033 per cent., general value, satisfactory.

In connection with the foregoing particulars, the special points of value in the soil are nil, and its special defects, phosphoric acid, lime, and iron. Its general character mechanically is very fair, and chemically, tolerable. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are summer fruit, vines, greenstuff, maize—with manure; while it is unsuitable, without special manure or special treatment, for heavy crops of cereals, roots, and citrus fruit.

The manures and treatment recommended for trial are—1. Liming—1 ton per acre—to break up the clay, and liberate the latent potash; 2. Dressings of natural manure, enriched with 2 cwt. bone-dust to each ton; or 4 cwt. per acre of Sugar Coy's No. 3 manure, or Gee's P.B.B. manure.

Speaking generally, in order to grow good potatoes, superphosphate should be applied at the same time as the seed, or good bone-dust when the ground is being broken up. Either of the two manures mentioned will supply the food most required. In view of the low percentage of iron, it may be found advantageous to use ½ cwt. of sulphate of iron, with the other dressings per acre.

NOTE.—(*a*) This amount of lime would be supplied in 2,055 lb. of quicklime, or 2,772 lb. of slaked lime, or 3,992 lb. of chalk. (*b*) This amount of potash would be supplied in 2,992 lb. of commercial sulphate of potash, or 12,461 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 3,256 lb. of commercial bone-dust, or 4,884 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 12,320 lb. of sulphate of ammonia, or 14,784 lb. of nitrate of soda.

General Notes.

Orchard Pests.

As showing the good results of a little care and attention in the orchard, the following is extracted from a letter received by the Department from Crookwell:—"I have sprayed our apple-trees with one of Goold's sprayers, using resin and soda-wash, and to 50 gallons of the mixture I have added one-third of a bar of washing-soap and 2 ounces of Paris green. I have sprayed for red spider. They were covering the trees in regular masses. I am happy to tell you that one spraying has nearly cleaned them off the trees, and I am confident that after next winter's spraying and the spring spraying I shall have them nearly stamped out. I have done all the spraying since the new year came in; the fruit is now looking quite healthy and growing splendidly.

Re Codling Moth.—I used bandages last summer, and removed all fruit from the trees that were affected with the pest. I have done the same this season, and now there is scarcely one to be found, while some of the other orchards are ruined with this pest. The moth can be kept down if properly looked after." The spraying and bandaging were recommended by the Departmental Fruit Expert when on a visit to this district, and it is gratifying to record that the advice was followed, and with such satisfactory results.

Prune-culture.

As proving the suitability of the climate of New South Wales for Prune-culture, it is interesting to note the following remarks sent to the Department from the Upper Murray district:—

"In the October number of the *Gazette* (vol. iii, Pt. 10) I see the description of the *Prune d'Agen*, which I am sure is identical with the prune which I have. I obtained the original tree from Baptist's nursery thirty-two years ago, and have now fifty trees of the variety bearing large crops, and mean to increase the number largely. I sent 80 lb. of the dried prunes to Albury this year for experiment, and they realized 9d. per lb."

This is certainly a satisfactory price, and proves the adaptability of the variety of prune recommended for the warmer parts of the Colony.

Destroying Crickets.

As orchards in all parts of the Colony suffer at some season of the year from the ravages of crickets, the following particulars of an experiment with a view to destroying them will be especially valuable. Our correspondent, writing from Adelong, says:—"I was rather amused at the remedy suggested by one of your correspondents in the January number of the *Agricultural Gazette*, viz., poisoning them by giving them rhubarb-leaves

to eat. The cricket is certainly very fond of rhubarb, a fact which I experienced last season when trying to keep them from some which I was saving for the Show. Although hundreds of them used to feed on it, I never saw one die from its effects. My young orchard was also suffering from their ravages. They first of all began to eat the bark of the young trees near the ground. I had no idea at this time that the crickets were so numerous. Knowing they were very fond of rock-melons and tomatoes, I strewed pieces of these around the young trees, thinking myself and two boys could go round after dark with a candle and destroy them by tramping on them. To my surprise the ground for several feet around the baits was black with crickets, and my plan was a failure. I then white-washed the barrels of the young trees, when, finding they were driven from the barrels, they attacked the tops, and began to ring-bark the principal limbs. I could then plainly see that unless I found some remedy I would have all my young trees destroyed. At this time a thought suggested itself to me that if I were to dig holes, place some tins in them, and bait them with rock-melon, tomatoes, cabbage-leaves, or any other sort of refuse they would eat, I could destroy them without much trouble. I tried it, and it worked admirably. My plan of destruction was to boil a large boiler of water every night close to the orchard. About 9 or 10 o'clock I would go round to the tins with a couple of buckets of boiling water. By this method I must have destroyed millions of crickets. Often I would find the tins 2 or 3 inches deep with dead crickets in the morning, about 1 quart of water having sufficed to destroy them. In a short time they were thinned down to a very great extent, and my trees preserved from their ravages."

In commenting on the above, the Entomologist remarks that he is entirely in accord with the process described. The trapping of crickets by means of tin traps has already been suggested in the *Gazette*, Vol. III, Pt. 4, p. 271.

The Bugong Moth (*Agrotis spina*).

In Vol. I, Pt. 1, p. 129, an article appeared which dealt with the habits of the Bugong Moth, and in which the imperfection of our knowledge of the species was referred to. The necessity for obtaining more accurate information of the life-history has been continually before the officers of the Entomological Branch, and on a recent journey Mr. Helms, one of the collectors, took the opportunity of being in the neighbourhood of likely country to continue the investigation. As is known, the moth affects, for breeding purposes, rocky country, and at Jindabyne, in the Cooma district, Mr. Helms attempted to obtain some of the larvæ or pupæ. In this he was unsuccessful, and attributes his want of success to being in the neighbourhood too late in the season. The following extract from his letter, however, will be found of interest:—"At the base of the huge and rugged rocks protruding through the highest ridges, immense numbers of the perfect insect are found under the flat stones scaled from the massive blocks by frost and decomposition; and in every creft and crevice they are hiding in thousands. I assuredly expected the larvæ a little below the soil under the grass at such places, but turned over many square feet in vain. Still I am of opinion that here the principal breeding-places exist, and that from these localities the enormous swarms emanate that periodically invade the low-lying country. Wherever these immense numbers of moths exist great numbers of crows may be seen hovering about, and generally greater numbers of these birds are busy at work in the cracks and rents of the rocks, devouring these insects wholesale . . . . . . There is one thing certain, that these

birds are of inestimable value as insect-destroyers, and certainly are not sufficiently estimated as such. So fond are they of these insects that they will scarcely touch anything else, and it is a well-known fact that a dead sheep, or other carrion, will be left untouched by them while the Bugongs are plentiful."

The Importation of Kainit and Potash.

With a view to enabling agriculturists to obtain Kainit and Potash Salts at a more reasonable price, steps have been taken by the Department to endeavour to have these salts placed on the duty-free list. The articles liable to duty are in the form of sulphate and chloride of potash, and are at present imported by two firms only for manurial purposes. Under existing arrangements our own farmers have to pay 10 per cent. duty, while those in Queensland, Fiji, &c., using these manures, escape the duty. Representations were made to the Collector of Customs, who replied that the matter could only be dealt with when a reconstruction of the Customs Tariff was considered by the Treasurer, and, therefore, arrangements have been made to bring the application before the proper quarter when such matters are being considered.

Reports on Tobacco-growing Districts.

Reports have been received from Mr. S. Lamb, one of the Departmental Tobacco Experts, on visits paid to Bathurst, Sofala, and Carcoar, with a view to ascertaining the condition of the tobacco industry in those districts. With regard to the first-named, it appears that all that is grown is on the Kelso side of the Macquarie River. Mr. Lamb visited plantations at Kelso and Eglinton and Brucedale, and had conversations with several growers and enterprising farmers. It appears that the quantity grown was decreasing on all hands; but on having the capabilities for export and the necessity for obtaining seeds of a variety suitable to the districts explained to them, several growers expressed the intention of trying further experiments on well-defined lines. Mr. Lamb expresses the opinion that, given the right sort of seed, intelligent cultivation, and perfect curing, tobacco can be produced at Brucedale and Peel which would bring a very remunerative price in England. At Sofala, Mr. Lamb was informed that very little tobacco was being grown on the Turon this year, and that next year the quantity would be still smaller; there being no sale for the leaf, there was no encouragement to grow it. An inspection of various small plantations disclosed the same tale of want of careful cultivation, unsuitable varieties, and careless curing. A well-to-do storekeeper took a very keen interest in Mr. Lamb's views for promoting a revival of the industry, and no doubt careful experiments will be carried out this year with varieties which are likely to be more suitable to the district and more likely to command a fair price in the London market, as there are on both sides of the river, both up and down stream, little flats of very good soil, many of which have produced good crops of excellent tobacco in the past. In the Carcoar District, Mr. Lamb found that owing to low prices very little tobacco had been planted this year. He had interviews with several influential business men and landowners, and gave information regarding varieties, cultivation, and curing, and also recommended that a variety should be planted which would grow rapidly and mature early, in order to come within the half-year which there is usually between the frosts. It appears that tobacco was extensively cultivated in the district several years ago, and some two-year old leaf which

Mr. Lamb tested was of excellent texture and flavour, albeit somewhat strong. As a result of this visit, several landowners have expressed the intention of making substantial experimental sowings under proper conditions, with a view to testing the London market with properly-grown and properly-cured leaf. On the whole, Mr. Lamb is highly satisfied with his reception at the various places, and at the interest displayed in the suggestions which he made with a view to improving the crop as to variety, growth, and curing.

National Prizes—Utilising Surplus Fruit and Vegetables.

The report of the judge (Mr. A. H. Benson) appointed to decide on the merits of the methods of utilising surplus fruit and vegetables in connection with the National Prize Competition of 1892, has been duly submitted to the Minister, who has approved of the following awards, in accordance with the recommendations in the report:—

The first prize is withheld; the second prize has been awarded to Mrs. Sophy Corrie, of Colo Vale; and the third prize to Mrs. G. E. Hooke, of Tamworth.

Maize in the Pambula District.

In a report by one of the officers of the Department of agriculture in the Pambula District, one of the chief products is stated to be maize. From 30 to 50 bushels per acre is now considered to be a good yield, whereas in former days up to 80 bushels was nothing uncommon, and often exceeded. The Maizena factory at Merimbula purchases more than the district produces, and also imports a good deal of corn from the northern rivers. This is, however, to some extent due to the fact that the corn grown about Pambula fetches a better price in the Sydney market than the northern rivers corn, because it is firmer. The weevil does not give much trouble, but a good deal of complaint is heard about the destruction caused by birds, wallabies, opossums, and, latterly, hares.

The Export of Fruit.

With a view to assisting fruitgrowers in finding a payable outlet for their produce, the Department of Agriculture has been in communication with several firms of high standing in connection with the English fruit trade. In a letter, dated 24th February, just received from Messrs. Knill & Grant, of Monument Buildings, Pudding-lane, London, who, it will be remembered, forwarded the barrel of Almeria grapes which recently arrived in Sydney in excellent condition, the following valuable advice is given:—"Apples will, we think do well this year, if arriving in good condition. We would advise shippers only to send by the regular steamers of the P. & O. and Orient lines. Oranges also we think is a trade that might be pushed a little more than hitherto, to arrive here during the English summer months. Lemons also are worth a trial, prices generally being good at that time of the year."

Messrs. W. N. White & Co., Covent Garden, London, advise the Department under same date, that fruit from Cape of Good Hope had been coming forward in considerable quantities for several weeks. Grapes, peaches, nectarines, and melons, packed in corkdust, under the supervision of W. N. White & Co's special representatives, arrived in excellent condition. Peaches

and nectarines were separately wrapped in fine paper, and then the cork-dust shaken amongst them. Plums were packed in layers with wood-wool (shavings) and paper. The following prices were realised:—Boxes of peaches, holding from sixteen to thirty fruits, 6s. to 12s. per box; nectarines, in same size boxes, holding from fifty to eighty fruits, 16s. to 31s.

Those that made the latter price were very fine fruit indeed, nearly as large as peaches, and with a splendid colour. Plums—bought more for show than trade purposes—about twenty boxes, holding from 100 to 150 fruits each, realised from 9s. to 12s. each. Grapes, in boxes holding 23 lb. of fruit, realised 9s. each.

Burning off Strawberry Plants.

The Fruit Expert, on his visit to various parts of the country, has recommended the cutting off of the leaves of strawberry plants, and burning them over the plants in the autumn, as a means of invigorating the plants and preventing their being attacked with blight. A correspondent at Sunny Vale, Milton, writes on the subject as follows:—"I tried the experiment on the strawberry, having about three dozen plants in the garden. From four or five of these I cut the leaves, and when dry set them alight on top of the plants, and then covered the plants over with a thick coat of rotten wood ashes, and I find that the plants are far healthier than they were the previous year, and have less blight on the leaf. The fruit is very good, but not plentiful. I shall try the same treatment this year.

Clearing Land.

An article appeared in our January issue (Vol. IV, Pt. I) describing a means of clearing land in the western and southern plains districts by the aid of a team of bullocks. This has produced the description of another method followed in the Wellington district, which our correspondent considers "a much better and more economical way." The communication is both clear and complete, and we cannot do better than give it in his own words:—

"It is done by means of two iron double pulley-blocks and steel-wire ropes and two or three good strong horses (one horse will easily pull saplings). These will do as much as eight bullocks and with a lot less trouble; the great advantage is that not every farmer can command a bullock-team, or even a team of six or eight horses, but every one does, or should, own a couple of good horses. The directions as to opening the soil around the trees and the cutting of tap roots apply in this case as in the case referred to above, and if the trees have been dead for some years so much the better.

Tackle Required.

"Four lengths 1 inch in diameter, best steel-wire rope—one length each 50 feet, 20 feet, 15 feet, 10 feet—each rope to have a very strong hook spliced on one end and a very strong ring spliced on the other end.

"A closed-linked stout anchor-chain with several large links and a strong hook.

"One pair extra strong double iron pulley blocks with strong swivel hooks at top and bottom.

"A good Manilla or flexible wire-rope for working in the pulleys, about 70 feet long.

"A light ladder 20 feet or longer.

Pulling down the Trees.

"In commencing operations hook the wire-rope round the tree to be pulled down, the higher the better; next hook the anchor chain round the butt of an adjoining tree; attach one of the pulleys to this, and the other to the wire rope, and passing the Manilla or flexible wire-rope through the two blocks draw out to its full length, so that the horses get a chance of a good pull without interlocking the blocks. The several lengths of steel-wire rope are to save trouble in removing the blocks and anchor-chain every time a fresh tree is pulled. Hitch the horses to the end of the pulley-rope and start them pulling steadily, when all but the very largest trees will fall at once, especially if the ground is moist. I have lately had several acres pulled down in this way, a lot of the trees being 30 inches in diameter. Everyone who has seen this tackle at work admits its superiority over the cumbersome team of bullocks or horses. The cost of the tackle should not exceed £5."

In order to practically test the efficacy of this method the then Director of Agriculture provided himself with the necessary tackle, with highly satisfactory results. With regard to the price given, he thinks that to obtain the best kind of tackle an expenditure of about £8, instead of £5, is necessary. The two blocks (double) cost 35s. each, and best quality steel-wire rope—1 inch—is 1s. per foot. Then the hooks require to be made very deep, so that they will not open with the strain. He has also found that a chain round the tree to be pulled down answers as well as, if not better than, the wire-rope, and may easily be raised to the required height by means of a light line, one end of which is attached to the chain. The loose end is then hurled over a branch and the chain hauled up, when it can be placed in position by a man who has ascended the tree for that purpose. The chain thus used is less likely to cut into the wood than a wire-rope.

We are at all times pleased to publish suggestions which have stood the test of practical application.

How Weeds are Introduced.

As an instance of the ease with which weeds may be introduced, the following will be of interest to all agriculturists. A short time since three plants were forwarded from the Hawkesbury Agricultural College to the Botanist for identification, with a note to the effect that they had been found growing on the spot where a box containing Smyrna fig-cuttings had been opened. These plants were found to be *Hypecoum procumbens*, *Vesicaria utriculata*, and *Artemisia campestris*, and they are recorded for the first time in Australia. In various parts of Europe they are known as noxious weeds, and prompt steps were taken to destroy them, so as to prevent the possibility of their spreading in this country.

Poultry.

Owing to the large quantity of matter for this issue, the poultry article is held over until next month.

As the cold weather is now upon us, it is most desirable that food which supplies as much heat as possible should be given to the birds. The morning soft mash should be given warm, and the evening meal may for a week or two consist of good sound maize—a woman's handful to each bird. Great care must be taken to prevent mouldy or diseased maize being consumed by fowls; it is far better to give a less quantity, provided it is clean.

It is well to begin getting breeding pens in order, and the flock should be looked over for likely birds. Some information in these matters will be given next month. Stud hens should be penned off at least a month before the stud cocks are put with them.

Testing Milk Supplied to a Factory.

With a view to giving a practical exposition of the mode of working the Babcock Milk-tester, and also to ascertain if any of the suppliers had been tampering with their milk to any great extent, Mr. F. M'Caffrey, dairy expert to the Department, visited recently the Pioneer Dairy Factory at Kiama. In all, eighteen samples were tested, one of which was of the previous day's milk. The fat of this sample turned completely black, and, consequently, was useless. The results showed that all the milk tested was of fair average quality, but that some suppliers were sending much better milk than others, as will be seen on reference to the following table:—

No.	Percentage of butter fat.	No.	Percentage of butter fat.	No.	Percentage of butter fat.
1	3·80	7	4·00	13	3·80
2	4·00	8	4·00	14	3·40*
3	3·60	9	3·80	15	3·80
4	3·60	10	3·80	16	3·80
5	3·80	11	3·60	17	3·60
6	3·60	12	3·60		

It may be mentioned that Nos. 2, 7, and 8 belong to one supplier; Nos. 5, 9, and 10 were taken from another supplier's milk; and Nos. 13, 15, and 16 from still another supplier's milk. The tests were in all cases read off by Mr. M'Caffrey without his knowing to whom any sample belonged. These facts not only show the correctness of the machine, but also the absolute impartiality of the proceedings.

Hawkesbury College Examinations.

The holding of examinations in Sydney for those desirous of entering as students at the Hawkesbury Agricultural College has been found to be both inconvenient and expensive to those residing at long distances from the metropolis. This is particularly the case when such an applicant fails to satisfy the necessary requirements. It has, therefore, been decided that when any youth wishing to enter the College happens to reside in a remote district, special arrangements may be made for his examination in his own district. This will be effected by means of a paper embodying the usual test questions to be answered under the supervision of some responsible person residing in the neighbourhood, who will also be asked to report on the character and physical aptitude of the applicant. Provided that the reports on character and aptitude are satisfactory, admission to be by order of merit in the results of the examination as decided by the Principal with the Science and English Masters.

The Summer Session of each year will commence on 15th August, and end on 23rd December, and the Winter Session on 3rd February, ending on 31st July. The next examination will be held towards the end of July, but owing to the number of applicants already entered, any vacancies which may occur will probably be filled up. At the session opening in February next there will probably be several vacancies caused by students, who, having completed their course, leave the College with diplomas.

* In this case the test-bottle met with an accident, a small drop being spilled.

Agricultural Statistics.

The following returns have been kindly supplied to the Department by the Government Statistician, who has this year put them in a form more convenient for reference. It will doubtless be readily admitted that the few days delay in publishing this issue will be justified by the inclusion of these valuable statistics:—

Total area cultivated and under permanent grasses, and area returned as prepared for cultivation, ring-barked, and partially cleared, in the various divisions and counties, for the year ended March-April, 1893.

Counties.	Total Area under Cultivation.	Area under Permanent Artificial Grasses.	Area Cleared and Prepared for Cultivation.	Area ringbarked and Partially Cleared
A.—Northern Division.				
1.—Coast.	acres.	acres.	acres.	acres.
Rous	24 749	64,819	3,421	268,484
Richmond	7 087	245	509	47,586
Clarence	35,064	107	466	75,588
Fitzroy...	3,951	694	389	52,756
Raleigh...	8,552	4,072	2,405	13,181
Dudley...	10,706	6,827	1,438	58,984
Macquarie	24,296	5,112	4,092	95,601
Gloucester	11,993	1,944	1,472	166,498
Total	126,398	83,820	14,192	778,678
2.—Table-land.				
Parry	6,672	388	3,139	101,092
Buckland	6,986	96	3,107	177,416
Vernon...	2,521	3,777	3,851	291,696
Inglis	4,840	129	2,081	66,156
Darling...	6,193	15	1,592	157,457
Sandon...	11,463	2,211	1,197	271,645
Clarke	1,135	582	500	92,283
Hardinge	3,930	2,396	492	123,803
Clive	5,043	106	453	25,920
Hawes	7	9	22	23,904
Gresham	88	....	....	....
Gough	14,766	4,005	921	162,633
Arawatta	7,050	182	332	131,159
Drake	410	50	7	127,476
Buller	352	15	60	19,466
Total	71,456	13,961	17,754	1,772,106
3.—Western Slope.				
Stapylton	95	14	12	42,758
Burnett	1,543	182	407	194,766
Courallie	160	6	53	29,371
Benarba	51	....	111	203,870
Murchison	6,116	159	948	253,960
Nandewar	1,717	735	920	204,449
Jamison	280	5	28	7,127
Denham	17	....	50	5,141
Leichhardt	361	....	129	56,209
Baradine	493	....	112	47,777
White	235	....	231	92,801
Pottinger	1,306	61	1 024	384,482
Napier	459	....	113	21,090
Gowen	2,037	38	160	110,380
Total	14,870	1,200	4,298	1,654,181
Total, Northern Division	**212,724**	**98,981**	**36,244**	**4,204,965**

Total area cultivated, &c.—*continued.*

Counties.	Total Area under Cultivation.	Area under Permanent Artificial Grasses.	Area Cleared and Prepared for Cultivation.	Area ringbarked and Partially Cleared
B.—Central Division.	acres.	acres.	acres.	acres.
4.—Hunter and Hawkesbury Valleys.				
Durham	18,212	5,378	2,058	516,649
Hunter...	2,210	202	773	56,771
Northumberland	23,041	3,780	2,951	222,846
Cook	9,639	1,064	996	38,285
Total	53,102	10,424	6,778	834,551
5.—County of Cumberland and Metropolis.				
Electorates of—				
St. Leonards and Metropolis...	3,086	575	39	447
Canterbury	1,241	681	10	720
Parramatta and Central Cumberland ...	16,998	3,578	987	31,707
Camden and Illawarra	2,070	173	480	3,439
Hawkesbury and Nepean	13,940	1,243	4,968	23,994
Total	37,335	6,250	6,484	60,307
6.—Table-land.				
Counties—				
Brisbane	5,656	4,652	7,220	724,113
Phillip	13,716	1,385	2,180	162,828
Bligh	4,616	85	1,089	297,722
Lincoln...	16,671	240	3,615	241,688
Gordon	14,560	525	5,023	227,835
Wellington	15,939	1,123	6,092	194,590
Roxburgh	22,490	2,538	3,696	72,857
Ashburnham	35,463	377	7,930	432,796
Bathurst	69,459	6,448	24,222	325,702
Westmoreland...	7,504	182	1,190	64,335
Total	206,074	17,555	62,257	2,744,466
7.—Western Slope.				
Gregory	234	....	136	124,309
Ewenmar	743	50	335	209,099
Oxley	363	9	335	178,982
Narromine	3,400	384	2,710	437,667
Flinders	146	....	311	149,335
Kennedy	1,619	13	1,490	504,842
Cunningham	2,768	14	4,578	920,806
Total	9,273	470	9,895	2,525,040
Total, Central Division	**305,784**	**34,699**	**85,414**	**6,164,364**

Total area cultivated, &c.—*continued.*

Counties.	Total Area under Cultivation.	Area under Permanent Artificial Grasses.	Area Cleared and Prepared for Cultivation.	Area ringbarked and Partially Cleared
C.—Southern Division.	acres.	acres.	acres.	acres.
8.—Coast.				
Camden	23,085	125,287	1,940	276,162
St. Vincent	11,329	33,996	2,582	210,473
Dampier	3,608	11,807	616	100,463
Auckland	6,148	10,935	1,484	259,519
Total	44,170	182,025	6,622	846,617
9.—Table-land.				
Clarendon	53,724	62	14,253	344,655
Forbes	11,707	182	3,122	234,684
Monteagle	21,424	1,461	6,280	442,294
Harden...	46,059	692	13,769	517,716
King	13,651	656	21,402	359,020
Georgiana	5,311	231	513	133,982
Argyle	16,180	1,120	2,003	229,725
Murray...	9,347	1,921	1,857	296,699
Cowley	785	1,122	103	51,344
Buccleuch	5,881	1,196	83	226,244
Wynyard	16,432	3,558	6,099	389,181
Goulburn	16,593	754	3,126	379,341
Selwyn	2,176	4,813	5,446	197,846
Wallace	4,308	2,736	132	88,280
Beresford	4,065	910	369	30,349
Wellesley	4,303	2,043	1,960	181,270
Total	231,946	23,457	80,517	4,102,630
10.—Western Slopes.				
Dowling	510	......	414	229,195
Gipps	2,097	1,714	1,260	962,812
Bland	23,274	54	10,261	762,754
Bourke	35,327	109	14,628	704,591
Cooper	5,030	102	5,005	885,408
Nicholson	5,674	10	1,325	66,105
Sturt	584	......	648	33,228
Waradgery	1,232	120	810	300
Boyd	689	30	407	47,522
Mitchell	25,363	294	2,825	562,980
Urana	9,399	1,268	11,966	776,907
Townsend	6,114	350	1,974	74,572
Wakool	2,906	334	1,732	316,077
Cadell	17,821	21	7,734	120,775
Denison	32,876	4,637	7,791	357,638
Hume	39,307	12,967	25,739	550,973
Total	208,203	22,010	94,519	6,450,937
Total, Southern Division	**484,319**	**227,492**	**181,658**	**11,400,184**
D.—Western Division.				
11.—Western Plains.				
Electorates of—				
Balranald	4,658	52	2,641	1,222,079
Bourke	889	56	625	568,106
Sturt	254	......	25	......
Wentworth	1,644	......	1,193	63 991
Wilcannia	455	......	354	......
Total, Western Division	**7,900**	**108**	**4,838**	**1,854,176**
Grand Total for New South Wales ...	**1,010,727**	**351,280**	**308,154**	**23,623,689**

Area, Production, and Average Yield per acre of Crops in the

GRAIN, HAY, AND

Divisions.		Wheat.		Maize.		Barley.		
		Grain.	Hay.	Grain.	Green Food.	Grain.	Hay.	Green Food.
Northern Division	Area	acres, 39,413	acres, 6,171	acres, 101,971	acres, 583	acres, 1,095	acres, 182	acres, 438
	Production	bushels, 622,135	tons, 10,393	bushels, 2,756,750	......	bushels, 20,684	tons, 299	......
	Average yield per acre..	15·8	1·7	27·0	......	18·9	1·6	......
Central Division ..	Area	acres, 111,586	acres, 23,568	acres, 41,329	acres, 2,793	acres, 1,559	acres, 565	acres, 954
	Production	bushels, 1,687,065	tons, 31,148	bushels, 1,429,504	......	bushels, 30,601	tons, 837	......
	Average yield per acre..	15·1	1·3	34·5	......	19·6	1·5	......
Southern Division..	Area	acres, 301,339	acres, 52,993	acres, 24,249	acres, 2,882	acres, 1,964	acres, 954	acres, 873
	Production	bushels, 4,500,677	tons, 68,326	bushels, 851,002	......	bushels, 40,515	tons, 1,627	......
	Average yield per acre..	14·9	1·3	20·6	......	20·6	1·7	......
Western Division ..	Area	acres, 583	acres, 6,664	....	acres, 8	......	......	......
	Production	bushels, 6,680	tons, 6,194	....	......	......	......	......
	Average yield per acre..	11·5	0·9	....	......	......	......	......
New South Wales..	Area	acres, 452,921	acres, 89,396	acres, 167,549	acres, 6,266	acres, 4,618	acres, 1,701	acres, 2,295
	Production	bushels, 6,817,457	tons, 116,061	bushels, 5,037,256	......	bushels, 91,801	tons, 2,763	.....
	Average yield per acre..	15·0	1·3	30·0	......	19·9	1·6	......

ROOT CROPS, MISCELLANEOUS

Divisions.		Root Crops.				Miscellaneous.					
							Sugar Cane.		Grape Vines.		
		Potatoes.	Onions.	Turnips.	Mangold-wurzel.	Tobacco.	Cut this year.	Not cut.	For Wine making.	For Table use.	Not bearing
Northern Division..	Area	acres, 4,269	acres, 8	acres, 45	acres, 4	acres, 72	acres, 11,560	acres, 15,191	acres, 454	acres, 186	acres, 119
	Production	tons, 12,951	tons, 24	tons, 183	tons, 40	cwt., 974	tons cane, 264,832	....	gallons, 95.253	tons grapes, 329	..
	Average yield per acre	3·0	3·0	4·1	10·0	13·5	22·9	....	209	1·8	..
Central Division ..	Area	acres, 8,021	acres, 44	acres, 128	acres, 10	acres, 145	....	....	acres, 2,166	acres. 1,649	acres, 968
	Production	tons, 21,060	tons, 146	tons, 493	tons, 42	cwt., 1,688	....	....	gallons, 530.147	tons grapes, 5,058	..
	Average yield per acre	2·6	3·3	3·8	4·2	11·6	....	....	244	3·8	..
Southern Division..	Area	acres, 6,201	acres, 5	acres, 49	acres, 11	acres, 631	....	....	acres, 1,526	acres, 352	acres, 752
	Production	tons, 17,469	tons, 11	tons, 384	tons, 170	cwt., 5,682	....	....	gallons, 305,839	gallons, 511	..
	Average yield per acre	2·8	2·2	7·8	15·4	9·0	....	....	200	1·4	..
Western Division ..	Area	acres, 11	..	..	..	..	....	....	......	acres, 24	acres, 45
	Production	tons, 25	..	..	..	..	....	....	......	tons grapes 33	..
	Average yield per acre	2·3	..	..	..	..	....	....	......	1·4	..
New South Wales..	Area	acres, 18,502	acres, 57	acres, 222	acres, 25	acres, 848	acres, 11,560	acres, 15,191	acres, 4,146	acres, 2,211	acres, 1,90[illegible]
	Production	tons, 51,505	tons, 181	tons, 1,060	tons, 352	cwt., 8,344	tons cane, 264,832	....	gallons, 931,239	tons grapes, 5,931	.
	Average yield per acre	2·8	3·2	4·8	14·0	9·8	22·9	....	225	2·7	.

various Divisions of New South Wales for the year ended March-April, 1893.

GREEN CROPS.

Oats.			Rye.		Millet.		Lucerne and Sown Grasses.		Sorghum for Green Food.
Grain.	Hay.	Green Food.	Grain.	Green Food.	Grain.	Green Food.	Hay.	Green Food.	
acres, 3,457 bushels, 88,521 25·6	acres, 13,713 tons, 21,071 1·5	acres, 379	acres, 88 bushels, 1,327 15·1	acres, 78	acres, 44 bushels, 582 13·2	acres, 117	acres, 4,241 tons, 11,264 2·7	acres, 2,507	acres, 1,069
acres, 7,400 bushels, 115,065 20·3	acres, 44,363 tons, 51,074 1·1	acres, 445	acres, 673 bushels, 10,455 15·5	acres, 120	acres, 432 bushels, 2,840 6·3	acres, 326	acres, 13,253 tons, 33,186 2·5	acres, 6,556	acres, 1,476
acres, 10,030 bushels, 227,985 22·7	acres, 43,693 tons, 59,993 1·4	acres, 1,453	acres, 487 bushels, 8,529 17·5	acres, 330	acres, 20 bushels, 270 13·5	acres, 69	acres, 3,796 tons, 6,352 1·7	acres, 15,268	acres, 5,611
acres, 3 bushels, 32 10·6	acres, 212 tons, 288 1·4	acres, 10	acres, 3 bushels, 45 15·0	......	....	......	acres, 101 tons, 226 2·3	acres, 39	acres, 10
acres, 20,890 bushels, 431,603 20·6	acres, 101,981 tons, 132,426 1·3	acres, 2,287	acres, 1,251 bushels, 20,356 16·3	acres, 528	acres, 496 bushels, 3,692 7·5	acres, 512	acres, 21,390 tons, 51,028 2·4	acres, 24,370	acres, 8,166

CROPS, AND MINOR CROPS.

Crops.					Minor Crops.				Total Area cultivated.
Oranges.		Other Fruit Orchards.		Market and Kitchen Gardens.	Peas and Beans.	Pumpkins and Melons.	Chicory.	Other crops not stated.	
Productive.	Not bearing.	Productive.	Not bearing.						
acres, 80 No. of cases, 11,049 138	acres, 82	acres, 1,939 value, £19,778 £10 4s.	acres, 853	acres, 608 value, £16,757 £27 10s.	acres, 24 bushels, 429 17·9	acres, 964 tons, 3,540 3·7	......	acres, 720 value, £6,240 £8 13s.	acres, 212,724
acres, 8,503 No. of cases, 676,242 80	acres, 2,325	acres, 12,004 value, £146,449 £12 4s.	acres, 5,358	acres, 3,693 value, £147,914 £40	acres, 276 bushels, 9,847 35·7	acres, 1,578 tons, 5,498 3·5	acres, 360 cwt., 19,465 54	acres, 1,108 value, £32,627 £7 8s.	acres, 305,784
acres, 73 No. of cases, 4,515 62	acres, 87	acres, 4,136 value, £43,816 £10 10s.	acres, 1,942	acres, 1,001 value, £27,981 £27 18s.	acres, 209 bushels, 5,603 26·7	acres, 274 tons, 943 3·5	......	acres, 1,060 value, £7,108 £6 14s.	acres, 484,319
acres, 5 No. of cases, 460 92	acres, 3	acres, 38 value, £1,537 £40 10s.	acres, 10	acres, 79 value, £6,280 £79 15s.	acres, 2 bushels, 20 10·0	acres, 11 tons, 44 4·0	......	acres, 36 value, £275 £7 13s.	acres, 7,900
acres, 8,661 No. of cases, 692,266 80	acres, 2,497	acres, 18,117 value, £211,580 £11 14s.	acres, 8,163	acres, 5,381 value, £198,882 £24 8s.	acres, 511 bushels, 15,899 31·0	acres, 2,827 tons, 10,034 3·5	acres, 360 cwt., 19,465 54	acres, 2,924 £46,250 £15 16s.	acres, 1,010,727

AGRICULTURAL SOCIETIES' SHOWS, 1893.

Society.	Secretary.	Date of Show.
Deniliquin P. and A. Society	H. J. Wooldridge	July, 20, 21
Riverina P. and A. Society, Jerilderie	M. Curtin ...	July 25, 26
Gwydir P. and A. Society, Moree...	S. G. Cohen ...	July 25, 26
Condobolin P. and A. Association	A. James ...	Aug. 1, 2
Corowa P. A. and H. Society	A. A. Piggin ...	Aug. 2, 3
Narrandera P. and A. Association	J. F. Willans ...	Aug. 2, 3
Forbes P. A. and H. Association	W. G. Dowling..	Aug. 10, 11
Grenfell A. and H. Society	G. Cousins ...	Aug. 18, 19
Northern Agricultural Association, Singleton	C. Poppenhagen	Aug. 23, 24
Cootamundra A. P. H. and I. Association	T. Williams ...	Aug. 30, 31
Murrumbidgee P. and A. Association, Wagga Wagga...	H. T. Davidson	Sept. 6, 7
Albury and Border P. A. and H. Society	G. E. M'Kay ...	Sept. 13, 14
Burrowa P. A. and H. Association	J. H. Clifton ...	Sept. 14, 15
Junee P. A. and I. Association	M. H. Davies ...	Sept. 20, 21
Yass P. and A. Society	B. A. Nicholls...	Sept. 20, 21

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Vol. IV, Part 7. *JULY.*

Contributions to an Economic Knowledge of Australian Rusts (*Uridineæ*)

By N. A. COBB,
Department of Agriculture.

CHAPTER VII.

Keeping Seed-wheat true to name. Causes leading to Mixed Seed.

The title of this chapter may seem to indicate that we have left our subject and are wandering into irrelevent discussion, but reference to later parts of our work will show that many of our recommendations are based on the supposition that wheats are true to name, and that seed-wheat is pure and good in every respect. Unfortunately this supposition is not always a safe one to make; therefore, we have felt obliged in the preceding chapter on varieties of wheat, and in the present chapter on the quality of seed-wheat, to deal with this doubtful element in wheat-culture in such a manner as to leave beyond doubt what our recommendations mean.

There is no truth clearer than this, that the market value of a product depends in no small degree upon its uniformity and reliability. We all know what it is to come to rely upon a given brand of goods, because of its excellence and uniform quality. Consider for a moment what lies at the bottom of this reliance which we, every day of our lives, place upon the names of various articles. It is simply that the name is made to stand in a commercial sense for the article itself. If we order any brand of goods by name the merchant has no moral or legal right to deliver and charge for any other. So highly is this connection between name and thing valued that we find names and trade-marks protected by law, and it is no uncommon thing to see men or firms so jealous of any imitation of their trade-mark or name, or any sale of other goods under this trade-mark or name, as to spend large sums of money in exposing the fraud. We shall not be far wrong in saying that the exact naming of commercial articles is the very back-bone of trade.

The greater the number of varieties of a given useful article the greater is the necessity for correct nomenclature.

The raising of wheat has been for a long time one of the greatest and most important of industries, and the number of kinds of wheat has increased to several hundred. We need not, therefore, dwell further upon the necessity for a system of wheat nomenclature. It is of great importance to the farmer, the miller, and the seed-merchant that wheat should be accurately and suitably named, and that they shall be able to get wheat true to name. It is a fact that this matter has suffered such neglect in this country that until recently a sample of wheat strictly true to name was an uncommon thing. A sample of wheat not containing a considerable percentage of grains of another sort than the majority was a rare occurrence. Several different wheats are here known under one and the same name, and, on the

other hand, the same wheat sometimes goes under several different names. This is a state of things proved to exist, and our assertions are not, therefore, simply so many assertions.

We leave out of account, for the present the kind of wheat it is best to grow, as we wish to speak at first only of the quality of the seed. We know from several years of very careful examination, that our wheat-farmers as a whole are not using seed of the best quality, and that every year sees the sowing of thousands of bushels of very inferior seed. Seed to be good must be pure and uniform; by which we mean that the grains should be all of the same kind, and as nearly uniform in size as possible, and at the same time large and solid. Solid seed produces a harvest of solid grain; large seed produces large and vigorous plants; uniform seed produces a uniform crop. These are rules that have been proved by the most careful experiment, and they have no exception in ordinary seasons. On the contrary, it is just as true that light seed gives a harvest of light grain, that small seed gives small plants, and that impure seed and seed not uniform in size give an irregular stand of wheat. The reasons for these facts are so self-evident that it seems almost foolish to point them out, but our eyes have recently been opened to the tremendous amount of carelessness that prevails in this matter of seed-wheat, and we are bound to speak out fully.

First of all, it is certain that four out of every five samples of seed-wheat, as it comes into our market, are impure; that is, are mixed or are not true to name. The seed, instead of being of one kind, is more often a mixture—in most cases, in fact, it is of from three to five sorts. No matter how carefully such seed may have been winnowed, it is very poor policy to use it. The different sorts will ripen at different times, and will be of different heights. How is it possible to harvest such a crop economically? If the grower waits for the late plants to ripen, he loses on the early part by shelling, and if he does not wait for the late part to ripen, he loses in yield in that part by cutting before it is ready. Again, how is it possible for harvesting machinery to handle economically wheat of varying length? Where the ears range all the way from a man's hips to his head, it is impossible with a stripper, or even a harvester, to get the crop into bags economically, for though the harvester may secure all the ears, the threshing machine will not work economically on uneven feed.

The case is much the same with uneven seed. The large grains give rise to large plants, the small grains to smaller plants, and the result is an uneven stand and a wasteful harvesting. The largest miller in the world, Mr. Pillsbury, of Minnesota, U.S.A., last year carefully winnowed at his mills a large amount of seed, and gave it away in the district on which he draws for his grist, remarking: "I think the idea of having wheat thoroughly cleaned, with the smaller kernels all taken out, would result in an increase in yield of at least two or three bushels per acre." These words, from one who has handled more wheat than almost any man living, should be carefully considered by wheat-growers.

Another point in the quality of seed-wheat is this: Let the farmer be careful to get the best strain of the variety he wishes to grow. Purple straw is a very popular wheat in some parts. Are our wheat-growers aware that there are nearly twenty sorts of purple straw, and that some of them are vastly better than others? We venture to say not; in fact, from numerous inquiries, we are positive that this is not generally known. When one sort of purple straw will ripen fully three weeks earlier than another sort, when the yield of some sorts of purple straw is fully thirty per cent. more than that of other sorts of purple straw, and at the same time

of a much superior milling quality, surely it is worth while to guard against putting in anything but the best.

It will be profitable to review the various ways in which wheat becomes mixed. The accidental or unintentional mixing of seed does not occur in any particular place or operation. We find that all parties connected with the raising, marketing, and milling of wheat are more or less responsible for various accidents and mistakes. The farmer, the thresher, the miller, and the agricultural show-man have each their share in giving rise to mixed seed.

The Farmer and Mixed Seed.

Where wheat follows wheat there is danger of mixing the seed if one variety follows another on the same piece of land. Self-sown wheat from the first crop comes up and mixes with the second crop, and so on. Mixing sometimes takes place very rapidly in this manner.

Where two different varieties are sown in the same paddock the broadcasting is often so done that the two wheats are mixed at the margins, and unless care is taken in harvesting mixed grain results.

Bags that have been imperfectly emptied of wheat are often used again for wheat of another variety. The grains of the first sort left in the bag become mixed with those of the second sort.

Mistakes are made in labelling bags—labels get lost or misplaced.

The Thresher and Mixed Seed.

A threshing machine may be a prolific source of mixed wheat. The thresher visits farmer A, and having threshed his wheat proceeds to farmer B. Unless the threshing machine be carefully cleaned, farmer B's wheat becomes mixed to some extent with farmer A's. Connected with this mixing is the danger run by farmer B of the introduction on his farm of weeds from A's farm. The danger of spreading weeds by threshing machines going from place to place is so great that some Governments have passed laws inflicting a fine on any owner of a threshing machine who fails to have his machine thoroughly cleaned before proceeding to a fresh farm. Such a law is not necessary if every farmer, in making his bargain with the thresher, stipulates that the machine shall come on to the premises thoroughly clean. No thresher careful of his reputation would think of hauling on anything but a clean machine.

The Miller and Mixed Seed.

The miller's bins and bags are a fruitful source of mixed seed. A bin or bag not thoroughly emptied, and then used for another variety of wheat, results in contaminating the second variety. When we recollect how much of the seed-wheat purchased by farmers comes from the local miller, we easily understand how a miller, careless with respect to these small matters, may soon introduce confusion into the wheat of the surrounding district.

The Agricultural Show and Mixed Seed.

Picked samples of seed-wheat competing for prizes at agricultural shows usually stand side by side open to public inspection and handling. It is impossible for some persons to resist the temptation to plunge the hand into a bag of fine looking wheat. As one bag of wheat looks very much like another to the inexperienced, a handful taken from one bag is frequently returned to another standing near by. Most of the seed thus exhibited becomes seed-wheat, and is consequently likely to be mixed seed. We have seen judges of wheat themselves mix samples in this manner.

We have not mentioned all the numerous ways in which seed-wheat becomes mixed, but what we have said may perhaps suggest care where formerly there has been none, and if so, we shall have done so much the more towards a solution of the rust problem, inasmuch as the purity and reliability of seed-wheat have something to do with its solution.

CHAPTER VIII.

The Artificial Cross-fertilising of Wheat.

Wheat is naturally close-fertilised, that is to say, each wheat plant contains in itself all the elements necessary to fecundation, and uses them exclusively for its own purposes. Doubtless, cross-fertilisation does take place occasionally through natural agencies; doubtless the fertilising element of one plant does in certain rare cases find its way to the ovary of another plant, and thus produces a natural cross; but this occurs so seldom that it must henceforth be left out of account in practical agriculture. It is well known that two wheats of different variety may be grown side by side for years without any change in the character of the resulting seed; the two sorts will reproduce truly year after year, each after its kind, and there will be no crosses, or so-called hybrids—that is to say, plants intermediate in nature between the two original sorts—or at least only very rarely. This rare occurrence of natural cross-fertilisation is due to the nature of the flower of the wheat plant, which is so constructed as to open only after fertilisation from its own elements has already taken place.

It is clear then, that if man wishes to produce new races of wheat by commingling the qualities of wheats already known, and to do it systematically and with speed, he must resort to artificial cross-fertilisation.

There are no great obstacles in the way of producing these artificial cross-breeds. The fertilising element of any variety of wheat acts perfectly well on the ovaries of any other variety, and produces cross-bred seed which is perfectly fertile; the operations necessary to bring about this artificial impregnation are simple and require no very special skill and no elaborate instruments; in fact, there is no reason why anyone having sufficient patience and skill to thread a needle should fail in crossing one wheat on another. Practice only is necessary. We do not mean by this that anyone may at once set himself up as an expert wheat-breeder, any more than he could in a day qualify himself as a breeder of race-horses or stud-sheep. There is just as much scope, nay, there is *more* scope, for the exhibition of judgment in breeding wheats than in most sorts of breeding, and no one may expect the highest success without years of experience.

Our object in the following paragraphs is to tell the novice how to go to work to produce a cross-bred wheat, and we shall begin by describing the wheat-flower and its organs, believing that if the breeder knows beforehand the exact nature of the organs he is working upon he will not only secure better results, but will take deeper interest in his work.

An ear of wheat as it first peeps forth is composed of from one to two dozen groups of flowers, called *spikelets*, arranged on opposite sides of a zig-zag stem called the rhachis. The spikelets are not opposite one another, but are arranged in an alternate manner, any one spikelet being attached to the stem or rhachis at a point between two spikelets on the other side. If a spikelet be cut away from an ear of wheat that is in blossom, it

will very likely present the appearance illustrated in the left hand figure of the adjacent illustration; hanging out from a cleft in the spikelet are seen three

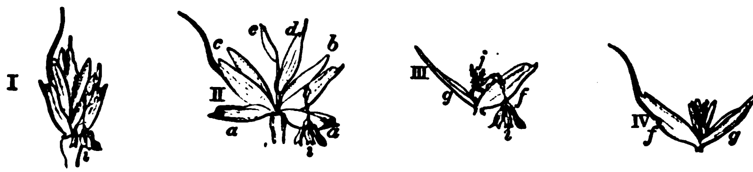


Fig. 98.—Wheat flowers, natural size.

yellow bodies called *anthers*, each anther being suspended by a delicate filament or thread. If the spikelet be opened with needles or a knife, it presents the appearance shown in the second figure. The two pieces of chaff, *a a*, are called *glumes*, and serve to protect the inner and more delicate parts; *b*, *c*, *d*, and *e* are flowers, each of which is composed of two pieces of chaff (called *palets* or *glumules*), enclosing the essential parts, the *anthers* and the *pistil*. The flower *b* has blossomed, and its three anthers are now hanging out, and will soon wither and be blown away; the flowers *c*, *d*, and *e* have not yet blossomed, in fact it is very often the case that the topmost flower (*e*) fails to blossom because it lacks some of the essential parts. Our two right hand figures show the interior of the flowers *b* and *c*; it will be seen that the palets are of unequal size and are unlike in form, and that where they join each other at the base, they enclose a small white body with two feathery plumes issuing from its top, though this is less clearly to be seen in figure IV because the three anthers, which have not yet been thrown out, partly hide it from view. This little white body with the two plumes (*j*, Fig. III) is the ovary, and is the part which by growth becomes the grain of wheat; the plumes, or *stigmas*, as they are called by botanists, wither as soon as the blossoming is over and almost entirely disappear, though traces of them can sometimes be seen on the tip of a full-grown wheat-grain.

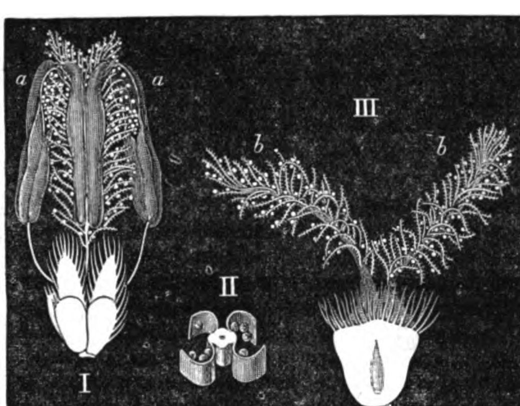


Fig. 99.—Ovary, stigma and anthers of a wheat-flower; magnified, after *Bauer*. I, the three anthers (*aa*) shedding their pollen-grains upon the branches of the stigma, the pollen-grains being shown as white balls (the ovary is hidden by the ciliated scales which immediately surround it inside the palets); II, cross-section of an anther more highly magnified; III, the ovary and its two stigmas (*bb*).

It is customary to speak of the anthers as the male organs of the flower, and of the ovary as the female organ. The anthers when ripe burst open

and let out a yellow powder, the *pollen*, composed of microscopic grains, and these grains, when they are caught on branches of the plumes or stigmas of the ovary, creep into them, or rather grow into them, in order to come into contact with a certain cell called the *ovule*, near the centre of the ovary. This contact results in impregnation, and after that the *ovule* can begin to grow into a grain of wheat; but without impregnation the ovary would cease to grow and become abortive. These facts are made clearer by reference to Figs. 99 and 100.

In order to produce an artificially cross-bred wheat-grain we must watch the progress of the blossoming and get ahead of Dame Nature. An ear of wheat begins to blossom near its middle, not at the bottom or top. As soon as blossoming has begun we shall find on searching among the flowers and opening them, that the stamens are in various stages of ripeness; this is indicated not only by the size of the stamens but also by their colour. A ripe stamen is yellow, an unripe one is green, and when approaching ripeness its colour is yellowish-green. The nicest point in making an artificial cross is undoubtedly in judging just when to operate. If we wait too long the stamens will have burst, and the pollen will have impregnated the ovary; it will then be of no use to apply any other pollen, for the decisive point is passed—the parentage of the future grain is already determined. If, however, we can find a flower whose anthers are on the point of bursting, and can remove them before any of their pollen gets loose, and can then supply a pollen to suit our own purpose, we can control the parentage and make whatever cross suits us. We must, however, guard against operating too early. There is a certain stage, a certain time only, at which the stigma will receive, and if the stigma is not yet ripe for receiving pollen, we may daub on pollen without end, and yet produce no cross. Fortunately there is a means by which we can judge unerringly of the ripeness of the stigma. As the wheat is naturally a self-fertilised plant, it ripens its anthers and its stigmas simultaneously; when, therefore, the anthers are ripe and ready to emit their pollen, the stigmas in the same flower are also ripe and ready to receive it. The rule then, is to open flower after flower until one is found whose stamens though they are yellowish-green, have not yet opened; having made absolutely certain of this, the three stamens are removed, care being taken not to burst them in the operation. This process of removing the stamens may be called *emasculating*. Having emasculated a flower, the ripe anthers of another variety of wheat are dusted against the stigmas, and the flower may be closed up again with the assurance that cross-fertilisation will take place without fail if all the operations have been carefully performed.

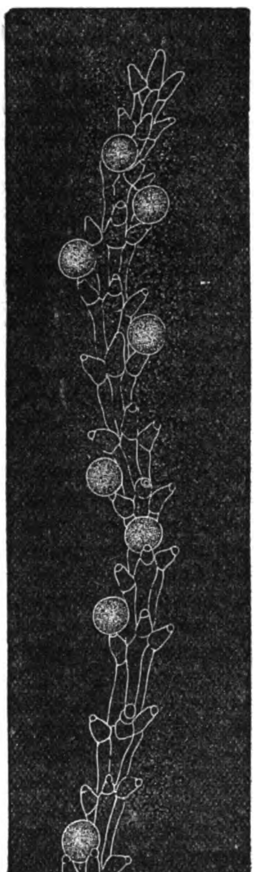


Fig. 100.—One of the branches of the stigma of a wheat-flower with grains of pollen adhering; magnified, after *Bauer*.

Some operators prefer to emasculate the flower while the anthers are quite green, and then wait a day or two before applying the pollen, the idea being that if pollen be supplied at once the stigma will not be ripe to receive it, and that before it can ripen the pollen applied will have lost its fertilising power. We do not believe that this resorting to two operations on separate days is necessary or advisable. If care is taken to emasculate a flower whose anthers are *already beginning to turn yellow*, the pollen for the cross may be applied at once, and even if the stigma is not at that moment ripe enough to receive the pollen, it will become so before the pollen has lost its fertilising power.

Equal care must be taken to select for the purposes of cross-fertilisation stamens that are neither too old nor too young, but in the zenith of their fertilising power. This is the case after they have become bright yellow in colour, and before they have been thrown out by the flower. It is necessary to guard against such ripened and empty stamens as the flowers have failed to throw out, for it not unfrequently happens that stamens accidentally remain in the flower long after fertilisation has taken place, and, of course, the pollen of such stamens is worthless.

It remains to describe the tools used in making crosses, and the methods found in practice to be most efficient and expeditious. While it is true that the

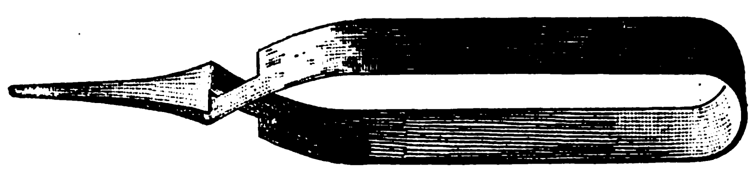


FIG. 101.

operations are so simple that they can be performed without special tools of any sort, it is far better to be provided with a suitable pair of forceps. To emasculate a flower with a pointed stick, is not difficult, but it requires much more time, and involves greater risk of injury to the flower than with

FIG. 102.

forceps. Two suitable forms of forceps are here shown. One remains shut when not in use, while the other remains open; the one is curved, while the other is straight. Both have their advantages. It will be found convenient to have the forceps fastened to an upper waistcoat button-hole by means of a cord about eighteen inches long.

The operation of emasculating is performed as follows: Take hold of the ear of wheat with the right hand and give it a slight curve over toward the right; with the thumb-nail of the left hand pry open the flowers successively until a suitable one is found; hold the flower open with the left thumb-nail while removing the stamens by means of the forceps with the right hand; seize only the very tips of the stamens with the forceps, and endeavour to remove all three at once. If the grip of the forceps is too low on the stamens, there is danger of injuring the stigmas.

Having emasculated a flower, it is necessary to so mark it as to make it easy to find it again. This is best done by marking not the flower emasculated, but the one below it or above it or opposite it. A very good and permanent mark is made by cutting off the tips of the spikelet with a pair of small scissors carried in the same manner as the forceps, *i.e.*, attached to the waistcoat. Accidents are less likely to occur if the scissor-blades are round-pointed. If much crossing is to be done it is best to have some system of marking; thus, having emasculated a flower, or made a cross, if the flower is on the right-hand of the spikelet, we clip the top of the spikelet above; if on the left hand of the spikelet we clip the top of the spikelet below. This clip will be indelible, and very clear to be seen, and consequently easy to find in future.

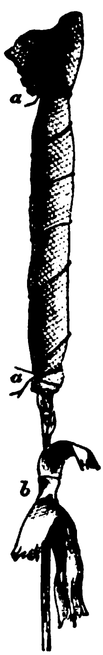


Fig. 103.—An ear of wheat marked with red tape (*b*), and tied up in mosquito netting (*aa*).

Having marked an emasculated flower, we mark the head by tying a bit of red tape round the stalk (*b*, Fig. 103), and can then safely leave it to secure the anthers whose pollen we wish to apply. To apply the pollen we open the flower as before, and gripping the anthers firmly with the forceps, rub them gently against the stigmas of the emasculated flower. Each time that the forceps are used they should be carefully wiped; this will prevent fertilisation with the wrong pollen, which might otherwise occur.

After the pollen has been artificially applied, the flower is allowed to close, and the whole ear is tied up gently in mosquito netting for a day or two (Fig. 103). The object of this is to keep the flower from accidentally receiving any further pollen. In two days time the ear is untied, and again enclosed in netting tied only at the top and bottom. The grains in the ear can then expand as necessary, and there is no danger that the cross-bred grain will be lost out.

Full notes are made as to the nature of the cross, and when the seed is ripe it is picked and preserved in an envelope, having its pedigree marked on it. Thus, for example,—

White Lammas (p) × Purple Straw (m)

which indicates that the seed is a cross between White Lammas and Purple Straw, and that White Lammas was the father (*pater*, hence p) or variety that furnished the pollen, and Purple Straw was the mother (*mater*, hence m); or we can omit the (p) and (m), it being always understood that the father variety is written first. Thus:—

White Lammas × Purple Straw.

Fixing.

To produce a single cross-bred seed is one thing—to produce a new breed or variety of wheat is another. The new cross-bred seed will produce a single plant, bearing, we will say for example, 300 seeds. When these 300 seeds are sown the labour begins. The 300 plants will not be all alike; on the contrary, there is in plants from newly cross-bred seed a marked tendency to "sport," or vary. In consequence, it is necessary to cull from among the 300 plants above mentioned all inferior and undesirable plants, and decide on what shall be the standard for the new variety. This decided, it is necessary to sow the seed from year to year until, by constant weeding out of the sports, there is no longer any tendency for the variety to vary. When this is done and the variety comes true, it is said to be "fixed."

Fixing a variety of wheat takes from three years upwards. There are some crosses that require a long series of years of the most careful attention, and some even that it has never been possible to fix at all. In general it may be said that the more violent the cross, the harder it is to fix it. By a violent cross is meant one in which the parents are very dissimilar, as for instance a cross resulting from a *durum* or bearded flinty wheat on a fine

FIG. 104.

beardless sort, for example, Medeah on White Velvet. We figure on this page ten ears from ten plants of the second generation of such a cross. That such a variety of heads should result from *one seed* in two years will, no doubt, astonish many readers, but it will cause less surprise to those who understand something of the laws of stock-breeding.

What the laws are that govern the properties of a cross-bred wheat is at present unknown, so that it is impossible to predict what sort of offspring a cross between two known varieties will produce. Moreover, there are two different crosses possible between any two varieties of wheat, as for instance when we cross White Lammas on Purple Straw we may use the Lammas first as the father and then again as the mother. The two resulting crosses will not be identical. In general we may say that the cross will be intermediate between the parents, but the chances are that it will be much more like one than the other. There are no doubt definite laws which govern the nature of the offspring, to discover which would be most interesting, and, we have no doubt, useful.

To make a cross it is of course necessary to have both parent varieties in blossom at the same time. To bring this about requires some forethought. If a very late variety is to be crossed on a very early variety it is necessary to sow the late variety very early and the early variety very late. If necessary the early variety can be kept from coming into ear by cutting back. There is no way of hastening a late variety to any great extent; careful culture and removing all the stalks from the stool except two or three are the only measures worthy of mention.

CHAPTER IX.

Improving Wheats by Selection.—Experimental Plots.

Any variety can be improved by careful and methodical selection. This method has been in vogue for many ages, and it is to it that we largely owe the gradual improvement that has taken place not only in wheat but in all cultivated plants. There is still plenty of room for improvement, however, and in the present chapter, we point out in particular not only the possibilities ahead, but give plain directions that will enable anyone so inclined to follow up our suggestions. All artificially obtained varieties tend to deteriorate, so that even if it were no longer possible to improve the wheat-plant by selection, it would still behoove us to practise careful selection for the purpose of keeping up the quality we have already secured.

While it is true that selection can be carried on in the field as ordinarily cultivated, and that this is the method anciently practised and one that is still in vogue, we strongly recommend the putting aside of specially selected and specially tilled land for the growth of plants from which to select.

An experimental wheat-plot must be carefully sown and carefully tended. The question is often asked "Is it possible to tell from the way wheats behave in a plot tended with the utmost care, how they will behave when sown broadcast in the usual way? Does it follow that because a wheat turns out well when drilled in and kept free from weeds by continuous cultivating—does it follow that it will do well in the hands of the ordinary wheat-grower?" The reply to these questions is this: "No; it does not follow that a wheat that does well in the one case will necessarily do well in the other; nevertheless experience has shown that in most cases we can tell from the behaviour of wheat in an experimental plot how it will behave in general culture." It would be absurd to say that because a given variety yields in a small experimental plot of one-fortieth of an acre at the rate of thirty bushels to the acre, that it will yield thirty bushels in the hands of wheat-growers generally. On the other hand, however, if on two experimental plots of equal size and similarly treated it was found that one variety yielded twice as much as another, it would be quite safe to say at once that the wheat which yielded the double amount would yield the better in general culture. Experimental plots will never be managed on a great scale on account of the expense. Experiments are ventures, and in most cases failures. There are nine failures to one success and each failure costs just as much as the one success, if not more. It is only when we can apply on a large scale the knowledge gained from successful experiments that the benefits of experimental work are seen. In the case of wheat-growing, experimental plots are so valuable that we advocate their use by all those who grow wheat on a large scale.

To be useful the plots must be situated on land suitable to wheat-culture—such land as is used by the wheat-growers it is intended to benefit. This

land should be as uniform in quality as possible, so that we may know when we get certain results that we have not to allow for that unknown element, the fertility of the land. We may illustrate this matter best by a simple example. Suppose we are trying two wheats for their relative productiveness and find that one, the first, yields ten per cent. more than the second. In such a case our result is worthless unless we know that the land in both cases was the same in every respect. To get uniform land is not easy, but it is not impossible. Small areas sufficiently uniform can be found in most localities. When a uniform area of sufficient size cannot be secured it will often be found that one varying in a slight degree can be secured. Such land may be used for experimental purposes if the change in the land takes place gradually in one direction. Thus if on the slope of a hill or near the bottom, land is found that in the upper part is a little coarser than lower down, we may compensate for this fact to some extent by placing the drills in our experimental plots so that they run in the direction of the change, that is up the hill, so that part of each drill is on the coarser soil and part on the finer. In any case too much attention cannot be paid to this matter of uniformity of soil. A deficiency in this respect has spoiled the results of more experiments in agriculture than any other one cause. In this connection it is well to recollect that the larger the experimental plot the less likelihood there is of the land being of uniform quality; it is all the more necessary to mention this fact because there is a notion prevalent that large experimental plots are to be preferred for the reason that any small irregularity in the land will be made up for in the average result of a large plot. This is to some extent a fallacy. The smaller the plot the more thoroughly we can control its uniformity. The only reason why the smallest possible plot is not the best is that individual wheat-plants vary so much from each other that it is necessary to grow a considerable number in order to obtain reliable results. The number of plants it is desirable to grow varies according to the object of the experiment, but there are few experiments that require the growth of above one thousand plants of a given variety.

In giving directions for the method of cultivating an experimental plot we assume that it is not the object of the experiment to find out the best method of culture; in such a case the experiment itself must determine what kind of treatment the land shall receive. For all other purposes the following will be found a good method:—1. Plough three to eight inches deep. 2. Harrow twice over, across the furrows. 3. If the soil is lumpy break the lumps apart with a spade or mallet after each harrowing. 4. Make perfectly straight parallel drills sixteen to eighteen inches apart and two to three inches deep in a direction across the furrows. 5. Sow the wheat by hand, grain by grain, putting only one seed in a place. Sow in an exact line at the bottom of the drill and place the seed exactly five, six, or seven inches apart as may be desired. If necessary have a line marked every five, six, or seven inches so as to get the seed sown exactly as directed. 6. Cover the seed uniformly one and a half to two inches deep. 7. Hoe once every week or ten days, and keep every weed down. 8. In moving about the plot be careful to avoid treading down the earth to the detriment of some plants more than others. A systematic arrangement of paths at right angles to the direction of the drills will be found serviceable in this connection. [*See* diagram.]

Let us consider each of these eight points more in detail.

1. The best experiments, and the most reliable opinion based on general observation, both favour a firm seed-bed for wheat. Very deep ploughing immediately before sowing is, therefore, undesirable. Eight inches is not

too deep where there is a good rainfall. Where the climate is very dry even three inches will answer.

2. Harrowing twice, or three times if necessary, brings the top of the soil into a fine and uniform condition, and harrowing across the furrow accomplishes this object quicker than harrowing with the furrow. Both ploughing and harrowing should be done in a regular and thorough manner, so as to secure regularity in the mechanical condition of the soil. If one part of the plot is ploughed or harrowed differently from any other part, the plants will be growing under different conditions in the two parts, and such plants cannot, therefore, be compared with each other in other respects. If, for instance, the yield is different in the two parts, it will be impossible to say how much of the difference is due to difference in the manner of ploughing and harrowing.

3. The soil should not be allowed to remain lumpy, for the obvious reason that such soil is less likely to be uniform in quality.

4. The drills should be straight, because the subsequent labour of cultivating and keeping down the weeds is much less if the rows are not crooked, aside from which, if the rows are not straight and parallel, and evenly

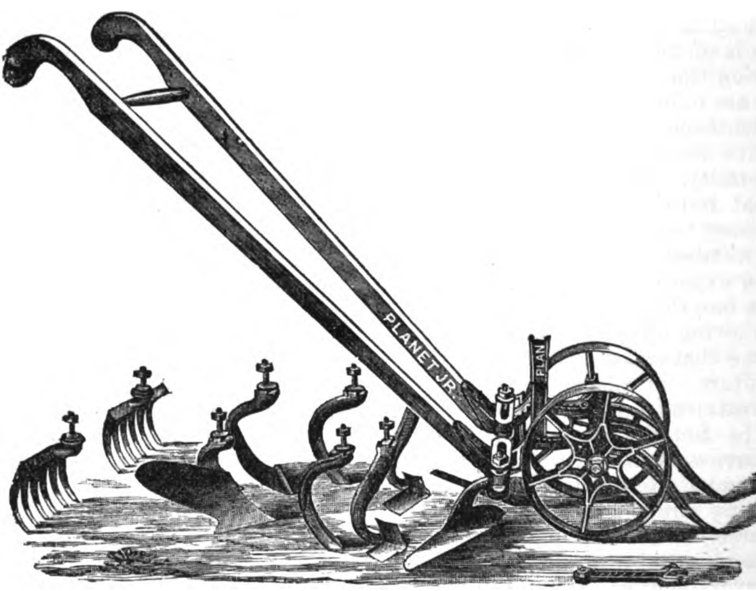
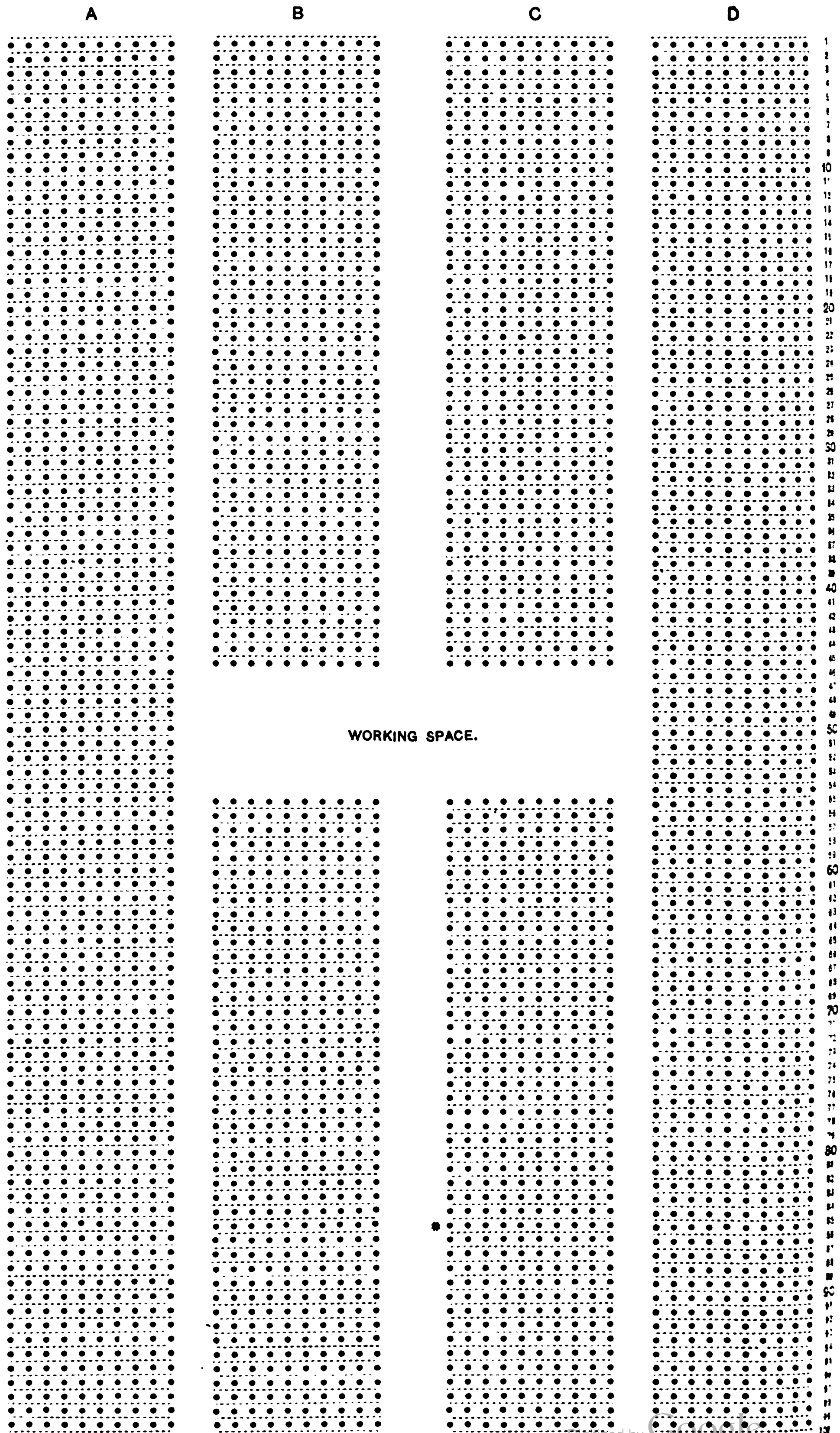


Fig. 105.—Planet Junior Hoe.

spaced, some rows will have a better chance than others, and the object is to give all rows the same chance. Experience has shown that sixteen inches is a convenient distance between the drills. A drill two to three inches deep allows of covering at least two inches. In general, it is best to cover wheat one and a half to two inches deep. Drilling across the furrows gives more uniform results than drilling with the furrows. The harrow fails to obliterate the furrows. If, therefore, the drills are made in the same direction as the furrows, it may happen that one drill lies on the top of what was a furrow, while the next may lie between two furrows, and the two resulting rows of plants would be likely to differ on that account. We must always


A
B
C
D
WORKING SPACE.

keep in mind that we wish to give all rows the same chance. There is no better machine with which to make drills, cover them when sown, and with which to keep down the weeds later on, than the Planet Junior Double-wheel Hoe. There are many Planet machines made, with more and different attachments, but the above is the best for experimental wheat-plots. We give the exact name, "Planet Junior Double-wheel Hoe," and a figure of the machine, on page 514.

5. We have never seen a drilling-machine that would drop seed accurately enough for experimental wheat-plots. Moreover, even if such a machine existed, or could be invented, it would be of little or no service. Each lot of seed is so small that the labour of emptying and refilling the machine would more than counterbalance any advantage in quickness of sowing. The only reliable way is to sow by hand, and not to entrust the sowing to any but very reliable persons. More than one seed in a place may lead to mistakes of two sorts. Two seeds close together give rise to stools interlacing, but having the appearance of one stool. Again, each stool is crowded by the other, and consequently grows otherwise than it would if not so crowded. If the seeds are placed exactly by measure each plant will be more likely to have the same chance as every other than if the seeds are not placed exactly. A field line is easily marked every five, six, seven, or eight inches by sowing in a piece of red yarn or tape.

6. The seed is to be covered uniformly for the same reason that all the other operations are performed uniformly. It will be found that good harrowing and breaking up of clods makes the covering much easier.

7. If weeds would only grow uniformly, a few would not do much harm in a wheat-plot, but inasmuch as they will not do so, but will persist in growing nearer some wheat-plants than others, and therefore robbing some more than others, the only safe plan is to extirpate every weed.

8. We insert here a plan of part of an experimental wheat plot at Wagga Wagga.

EXPLANATION OF DIAGRAM.

A, B, C, and D are four tiers of wheat, separated by paths, and sown in drills thirty feet long. There are one hundred drills in each tier.

Tier A	contains	drills	1 to 100.
Tier B	,,	,,	101 to 200.
Tier C	,,	,,	201 to 300.
Tier D	,,	,,	301 to 400.

This enables us to easily locate any drill. Thus, if we find on referring to our notes that White Lammas is sown in drill 284, we proceed at once to the drill marked with a star. We are enabled to do this the more easily by having every tenth drill of one of the outside tiers indicated by a sign-post bearing its number in characters large enough to be read across the plot. The alternate drills (indicated in the diagram by the faint dotted lines) are sown with a rust-liable variety, as it is our constant object to test our varieties with reference to their resistance to rust. These drills of rust-liable wheat are not numbered; they are regarded as blank. We reserve a space in the middle of the plot as a space to work in at harvest time and other times. This reservation introduces no confusion in the numbering, as we simply fail to sow drills 246 to 254 and drills 346 to 354. By reserving the *centre* of the plot for working room we save much travelling in the course of a season's work. The plot is enclosed with wire netting 3 feet high, to exclude poultry and other animals. This is a wise precaution, as a rabbit or other small animal will quickly make away with a drill of wheat, and is generally perverse enough to select that which is most highly prized.

Tobacco as a Farmers' Crop in New South Wales.

(*Continued from page* 430.)

By G. F. SUTHERLAND,
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Liquid Manures.

In some countries, such as India, where individual plots of tobacco cultivation rarely exceed a quarter of an acre in extent, it is not unusual to apply a liquid manure to the plants at this stage of their growth, with very beneficial results. Potash nitrate (saltpetre), where available, may be most economically supplied in this form.

Hilling.

When the plants have attained a height of 12 inches to 15 inches, they should have the earth drawn or heaped around the stem to afford them the necessary support. This work, termed *hilling*, may be done by either a light single or double mould-board plough, or an implement similar to the latest fashion of maize cultivators, which can be gauged to various widths and carry two mould-boards on the after teeth, that heap the soil round the plant to the desired height. In the past this work was done by the hoe, but the above method will be found more economical, while equally efficient, if performed with care. In the case of very high-growing plants they may require to be hilled twice in the course of the season.

Priming and Topping.

The field life of the tobacco plant in this Colony, with favourable weather, should range from ninety to not more than one hundred and ten days, the flower-buds commonly making their appearance from the seventh to the ninth week of this period. These, and two or more of the upper leaves, after attaining a certain development, should be nipped off, except in the case of those plants required for seed. This operation, styled topping, is generally conducted at the same time with the somewhat similar work of priming, or the removal of the ground-damaged and broken bottom leaves. Although some farmers, notably in France, where the crop is most carefully grown under the superintendence of the *Regie Nationale*, prime as early as the fourth or fifth week after setting out, so that the juices of the plant are not wasted on the nourishment of unmarketable leaves.

The object of both operations is to retain only such number of perfect leaves on each plant, as it can thoroughly develop and mature. The sap that would have gone towards the growth of flowers and seed is thus diverted to the enrichment of those leaves which will form the crop, and upon the merits of which, individually, the farmer entirely depends for a reward for the labour and expense of their growth. When topping is per-

formed too high, the upper leaves remain poor and papery, much depreciating the value of the yield. Should a plant that can only properly mature twelve leaves be left with sixteen, there will not only be no gain in weight, but a distinct loss of quality will be apparent. What a prominent agriculturist of this Colony termed the science of "common sense" is particularly requisite in this work, as no arbitrary opinion can be laid down as to the number of leaves to be left on each plant. So much depends upon the variety of tobacco grown, the strength of the soil, and resultant condition of the plant. The number of leaves to be retained ranges, according to circumstances, from six to twenty-two, and must in each case be decided by the observation and experience of the farmer interested, guided by the object to be attained. This method is much more likely to be productive of correct results than the blind following of such dogmatic aphorisms as "prime high and top low," inculcated in some hand-books, and which, like many more wise saws, is only partly true and no guide of action. There is a consensus of opinion on the part of the most experienced tobacco planters and German chemists, who have carefully investigated the matter, that there is a decided loss of aroma in the leaves from the premature removal of the flower buds that is not often recouped by the increased yield so obtained. It is therefore advisable, except in the case of late crops, to defer the operation of *topping* till the flower buds have appeared with some regularity throughout the field, so that the work once entered upon may be performed without much interruption, and so tend to uniformity in ripening. The pinching off of flower, stalks, and leaves, is work for which children are well suited. It should be neatly and deftly performed, so that the wounds may not hinder the growth of the plant by dissipating its resources, or damage be caused to the remaining leaves, which will now rapidly expand and increase in body after receiving the above attentions.

Seed Plants.

Plants reserved for seed should be of the strongest in the field and distinguishable by being attached to a tall rod, firmly fixed in the ground. This will also serve to support them against strong winds. They should receive the same care in suckering as the other plants, and, as insecticides may not be used on them with safety, worming should be done by hand. When the seed-pods have ripened, which may be known by their turning a dark-brown colour, they may be harvested either by cutting off the seed-heads and hanging them head down in a dry place, or, where field insects attack the pods, which they frequently do, the whole plant may be pulled up by the root, even before perfect maturity, and allowed to ripen in a like inverted position in the curing house.

Suckering.

Flower buds having, with the above exception, been remorselessly destroyed, nature immediately asserts its will by throwing out buds (suckers) at the axils of the leaves and stem which if left to themselves will develop into leaves and flower stalks. These intruders must be constantly removed and should never be allowed to grow beyond 2 inches in length. Their existence of course is at the expense of the vitality of the plant which we are interested in making as perfect as possible. This work, known as *suckering*, becomes almost continuous for the remaining period of the field life of the plant. This will vary from two to four weeks, according to the merits of soil and climate, which in some measure determine the number

of growths of suckers that will be thrown out. This number will vary and will be greater in the more stimulating climate of the northern seaboard than elsewhere; but in every case a careful examination and trimming of the plants will be necessary every three or four days. In the earlier work of tobacco growing, intervals of varying length will occur during which the every-day presence of the labourer among his plants may not be necessary. From the appearance of the first sucker, however, till half the crop has been placed in the curing shed, his attention will be fully occupied in doing justice to his 3-acre charge, either indoors or out. It will greatly conduce to the perfection of the crop if the field operations just described are carried out after the dew has left the plants, when they have become tougher and less liablé to injury.

Second crop.

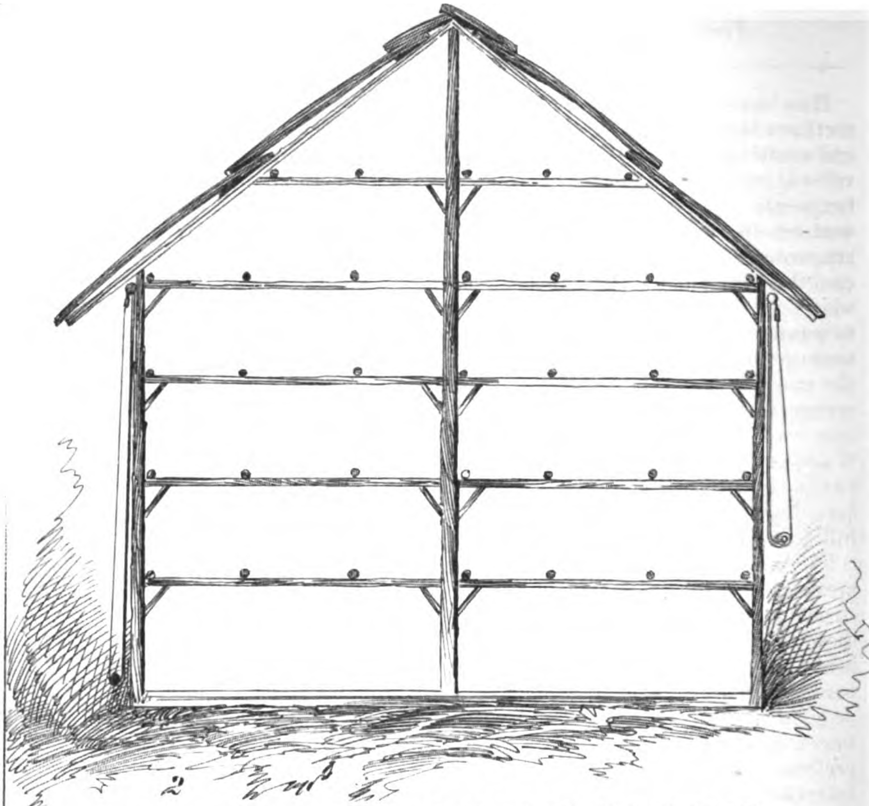
In the northern half of the Colony, if the harvest is moderately early, a second or "ratoon" crop, not inferior to the first, may in many districts be legitimately expected Where such conditions exist, the same assiduity and attention to the details of cultivation as previously commended will be necessary.

Ripening.

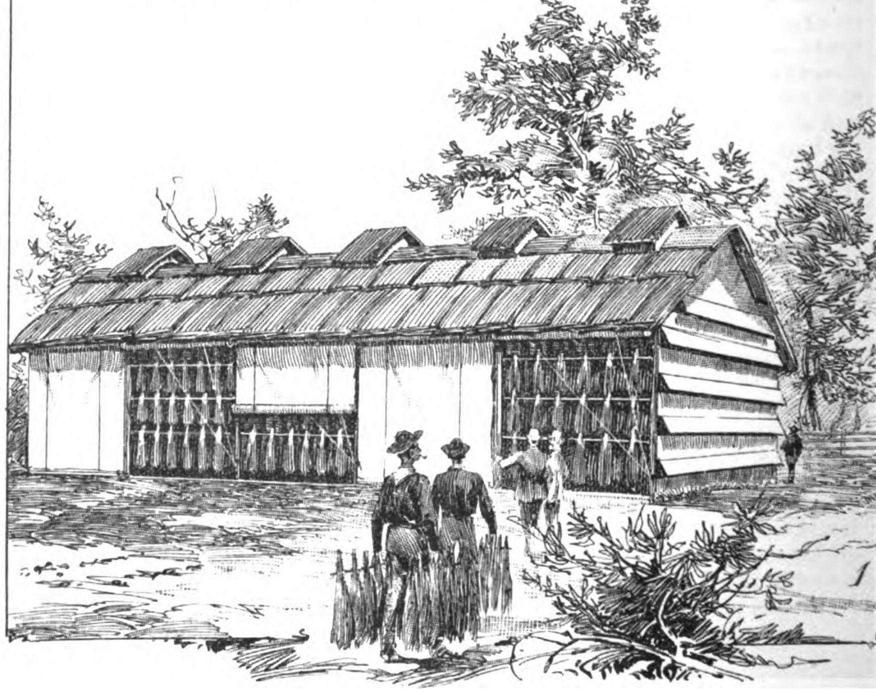
Within the period stated, signs of advancing ripeness will be observed throughout the field, and are not difficult of discernment by anyone even slightly acquainted with the crop. The luxuriant green of the plants gives place to a marbled or mottled pale green and yellow colour; the veins appear swollen and the leaves heavy and fleshy with a gummy feel, while the tips, when doubled back, break with a clean fracture. At this period, being ready for harvesting, we will leave our crop for a little while, to consider the subject of curing-shed accommodation, which it is incumbent should at this time be in perfect readiness for its reception; but before temporarily leaving the field, it may not be amiss to suggest what ought to be done with the primed leaves and suckers removed from the plants. There are two methods by which they may be usefully disposed of One is to place them in the compost heap, whence their valuable properties may be returned to the soil, and the other is to dry them in the shade, after which they make an excellent infusion, in conjunction with washing soda, for the destruction of insect pests on fruit trees, flowering plants, &c. On no account should primings be sent to market, where, apart from the distinct dishonesty of supplying the basis of the "cabbage-leaf" cigar, and the "oil rag" plug, the more powerful argument of insufficient price will show the unadvisedness of such a proceeding. The maxim that "the whole world wants good tobacco," is with little exception the guiding principle of the modern manufacturer, and if the New South Wales grower will undertake to supply such only, the present depression in prices would I think speedily disappear.

Curing-houses.

The style of structure and accommodation required in a curing-house will depend upon the system of preparation of the leaf to be adopted. This, in the present initial stage of the industry, and for economic reasons, may be best decided by consideration of the climatic conditions that prevail in the various circles of tobacco cultivation in the Colony. Of these there may be said to be three, enjoying comparatively different and definite circumstances, and demanding a similarly varied treatment of the plant.



No. 2.—END SECTION OF CURING HOUSE.



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No. 1.—CURING HOUSE.

They are—1st, the north-east coast districts, from the Hunter River northwards, which have a more or less humid atmosphere; 2nd, the north and south table-lands, of which the Peel and Upper Murrumbidgee River valleys, and that of their tributaries, having a more moderate rainfall and temperate climate, may be accepted as representative; and 3rd, the dry western districts, such as the valley of the Lachlan, where a desiccating atmosphere prevails that will have to be met by special precautions. In each case the provision recommended will be for curing under cover, and of the whole plant. This latter, although theoretically an imperfect system, owing to want of uniformity in ripening of all the leaves simultaneously, is, on account of labour conditions and the probable commercial value of the crop, the most feasible means of performing the work. A system of single-leaf curing introduced in America about thirteen years ago will be described later on. As the greater part of the tobacco now grown in New South Wales is produced under the conditions embraced by the second or temperate divisions, I will endeavour to explain its requirements first. My conclusions have been arrived at after actual experience of the governing causes and full consideration of all necessary conditions.

Owing to the favourable nature of the climate enjoyed within the limits prescribed, the curing-shed will not need to be such an expensive or solid structure as that required in the other two divisions. The building for these latter will more closely approximate to the typical American curing-house of the tobacco *belt*. It may be built of sufficiently stout and durable barked but undressed posts, supporting a well pitched weatherboard, shingle, or good stringy-bark roof, with wide projecting eaves and the necessary tiers inside for hanging the tobacco upon. The gable walls must be enclosed, preferably with weatherboard planking. Several of these weatherboards, at intervals of 4 feet, ought to be hinged or made adjustable so that they can be opened for the admission of light and air when necessary. The side walls should be protected by movable screens of strong bagging cloth hung on rollers (smooth saplings, 2 inches in diameter) that will enable them to be drawn easily up or down in the same manner as a window-blind, as may be desired or required by the vicissitudes of the weather. A batten and loops at the bottom to keep them in position when drawn will also be useful. The roof should have ventilators at intervals of 10 or 12 feet along the ridge of the building that may be opened or shut at the pleasure of the curer.

The shed should occupy a dry and well-drained position, and be end on to the direction from which rain storms are principally experienced. If this is impracticable, that side of the house on which bad weather mostly prevails should have its roof, or a skillion, continued so far towards the ground as to prevent damage. Provided, however, a sufficiently strong and close material is used for screens, and ordinary care is observed in their manipulation, no injury from this cause need be anticipated. If the cloth is first treated to a good wattle-bark tanning, a simple process which any farmer can perform for himself, and carefully stored in a dry place when out of use, these screens will last and do efficient service for many years.

The hanging area required for 6 acres of tobacco, which may be taken as a guide in the construction of larger or smaller buildings, will be embraced in a shed, the inside measurements of which are: Length, 65 feet; width, 25 feet; height at wall-plate, 17 feet; and at ridge, 27 feet or more. The interior should have five tiers of scaffolding for the support of the tobacco sticks, the lowest being 5 feet from the ground, and the others at intervals of 4 feet in height. This distance will, as a rule, afford ample hanging space for goodly sized plants without touching those above or below. The length

of the building will be divided into five sections of about 12 feet each by the uprights and cross-beams, as shown in figure 2. The latter, as may be seen from the plane section of a single tier figure 3, support the parallel poles on which the tobacco sticks in their turn rest. The poles (*b*) of about 3 inches in diameter should be nailed to the cross beams (*a*), spaced about 3 feet 10 inches apart, thus affording 6 rows to the width of the house, and leaving the poles of each tier directly over one another. The sticks or laths upon which the plants are to be hung will require to be 4 feet 6 inches long, to give a 4 inch rest on the poles at either end, ½ inch thick, 1½ inch wide, and, where tobacco is speared, be slightly tapered at one end to receive the dart. Fourteen sticks or thereabout will be required for every 100 plants.

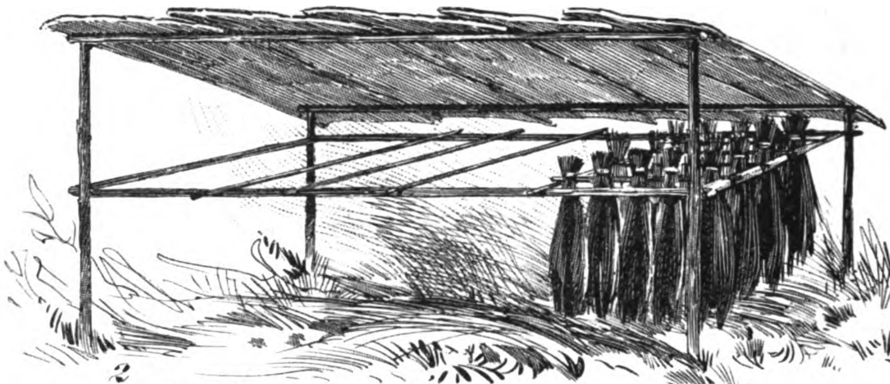
The accompanying sketches will give a fair notion of the kind of building and fittings recommended, from which iron, except in the form of the necessary nails, should be rigorously excluded. Its use in the past for roofing purposes has had a most prejudicial effect upon the tobacco growing industry of this Colony. With the above description of house, perfect curing may be performed, and where more extensive cultivation is practised its capacity may be quadrupled by the adoption of the following auxiliary.

Flue Curing-house.

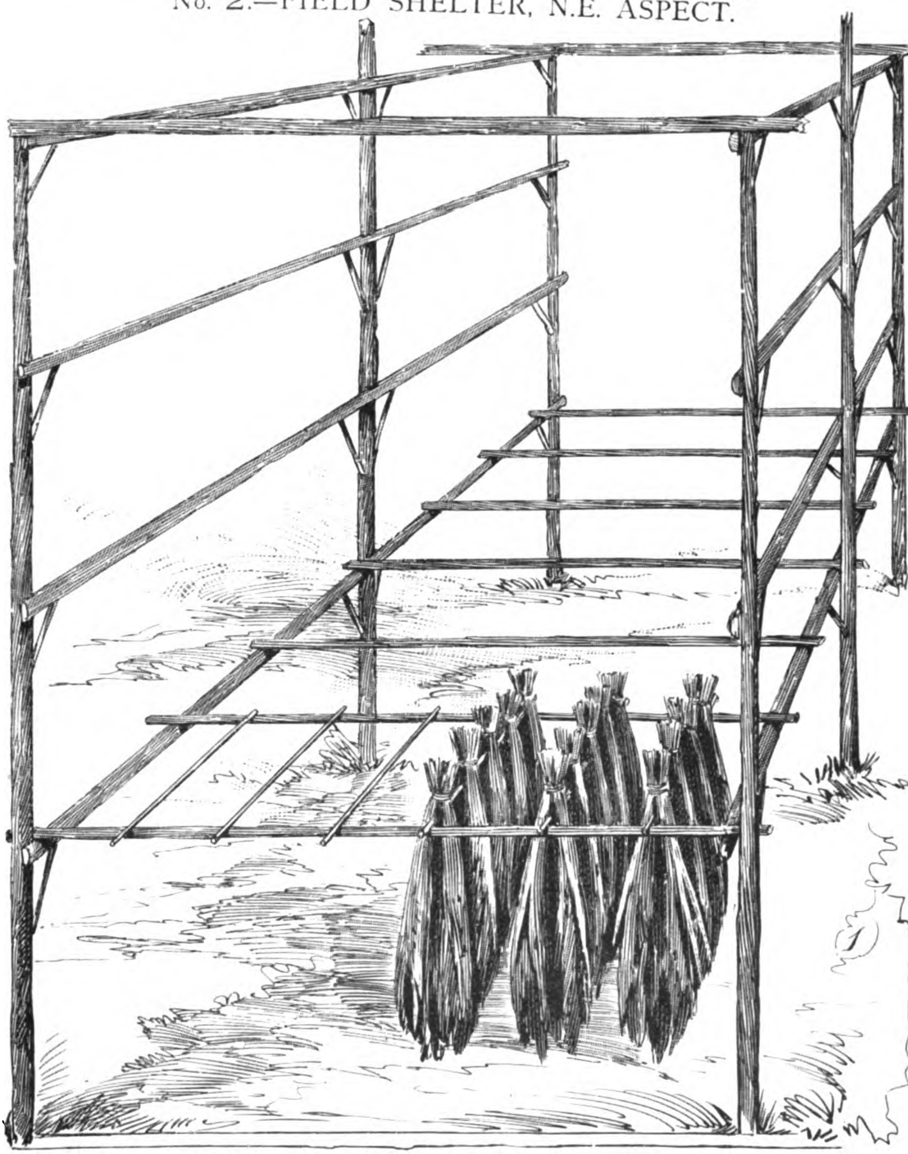
In close proximity to the shed just described, erect another building of one-sixth the capacity of the former, *i.e.*, of similar width, height, and fittings, and about 11 feet long. It must, however, be wind and weather tight, and have a sufficiency of manageable ventilation in walls and roof for the admission or exclusion of air, as may be found necessary. Its chief desideratum is a perfect command over the internal atmosphere. A circular sheet-iron flue, leading from a protected fire-place outside, should be taken round the inside of the building at a height of 6 inches from the floor, and a distance of 30 inches from the wall, returning to a convenient chimney outside. A slab, or board-house, resting on 3 feet high masonry walls, with a sharply pitched and well ventilated roof, of suitable material, will answer the purpose of this building, which is to more speedily dry out the plants after they have attained a proper colour in the neighbouring shed. This greatly shortens the time ordinarily required for this purpose, and enables the farmer to place his leaf on the market very much earlier than he otherwise could. It will also, as previously stated, greatly increase the capacity of the ordinary curing-shed, which may virtually be filled four times with green tobacco in the two months or so during which the harvest lasts. In limited cultivation, however, the single building will be found adequate, and when it may be thought desirable to use artificial heat the best plan will be to sink trenches in the floor, say 4 feet by 2 feet, by 20 inches deep, in the centre of each 12-foot section, having perforated sheet-iron covers over them to minimise the risk of fire. Partly, or wholly dried tobacco is very inflammable.

Fully enclosed Curing-houses.

For either of the other two circles of tobacco cultivation previously defined as the humid districts of the north-east coast, and the corresponding dry localities of the west, the curing-house requirements will be very similar.. In both instances they demand a complete command of the internal atmosphere of the house in the one case against excessive damp, and in the other against an equally injurious desiccating climate. Either of these extremes is objectionable, and renders good curing impracticable, except through the aid of a perfectly weather-tight house, the internal fittings of which will be



No. 2.—FIELD SHELTER, N.E. ASPECT.



No. 1.—PLAIN SECTION, SHOWING LOWER TIER OF CURING HOUSE.

(116143-93.)

the same as that previously described, the difference being only in the material of the shell.

For the coast a wooden structure will best answer, being more safe from fire, and lasting longer, if raised on 1 or 2 feet of masonry foundations. In the west a less permeable material will be required, for which *adobe* (sun-baked clay) walls, with a projecting wood or bark roof, will best suit the climate and purpose. Such buildings are cheap, easy of construction, and lasting, particularly if the clay is puddled with well thrashed wheat-straw, chopped to about 4-inch lengths. It will make equally good dwelling houses, being cool in summer, and warm in winter. The shutters of doors and windows required for access and wall ventilation may be of grass or straw hurdles, bark, or any rough material, so long as it is efficient.

Roof Ventilation.

A properly ventilated roof is in every case an absolute necessity. The natural tendency of the moisture evaporated from plants being to rise, and if means, such as I have freely indicated above, are provided, it will duly do so and escape. But without such ventilation the atmosphere speedily becomes saturated, the plants sweat, and will house-burn (decompose). A portion of this atmosphere, condensing on the roof, subsequently falls on the plants, permanently discolouring them, all the affected tobacco being rendered unfit for sale. From this experience it will not be difficult for the reader to realise the demerits of an unventilated, and non-absorbent iron-roof, which, it is to be regretted, is in such general use for this purpose. Grass, straw, or rush-thatch forms an ideal roof in all, except the risk from fire. From the next article, in which it is proposed to explain the various processes of curing, the importance of this subject will be better understood.

Field Shelter.

When a tobacco-field is at some distance from the curing-shed, and carting of the plants thither at the proper time may not always be practicable, a temporary field-shelter of bark or thatch, as shown in figure 4, will be found of the greatest assistance. This is especially the case during early harvest, when a burning sun usually prevails that would speedily and irreparably damage any cut plants left unduly exposed to its influence. The accommodation of such shelter may be for 700 or 800 plants, that number, owing to irregularity in ripening, being about an average day's cutting off a 6-acre field. Its aspect should be such as to afford shade from all but the morning sun, which, by the time the shelter will be occupied, shall have passed off. The shelters are only intended for temporary use, and each day's contents should be carted to the curing-shed in the afternoon or evening.

Methods of Hanging Plants.

The two principal methods of hanging tobacco are by "spearing" and "straddling" the split plants, the latter system being the most popular, and one which is in general use in New South Wales. The former is done by temporarily adjusting a spear head on the end of a tobacco-stick, made small enough to receive it. With one end of the stick resting on the ground against the hollow of the foot, or in a mortise hole in a log, take the butt of the plant, and, with both hands, force it over the spear-head on to the stick. This, when full, is ready to hang, the spear-head being slipped off and on to

another, and the operation repeated. A conical, hollow, sheet-iron spear, 7 or 8 inches long, having a ¾-inch flattened socket to fit the stick, is all that is wanted.

For "straddling," which has many recommendations, the plants are split in the field at the time of cutting by a heavy chisel-headed knife, which divides the main stalk from the crown to within a few inches of the ground, close to which point they should be cut. Split plants will certainly cure quicker, some say brighter, than by the other method, but at the cost of a certain loss in weight. They are also convenient to handle in the shed. But where a light-bodied tobacco has to be cured in a dry climate "spearing" will recommend itself. The process of evaporation of moisture from the plant by this means being more prolonged, will afford a better chance of the leaves attaining a good and uniform colour, and minimise the danger of green curing from their premature drying.

The system of hanging plants on small 54-inch sticks, here commended, will be found much more convenient than the present cumbersome habit of using 10 or 12-foot poles. These latter require two men to lift them, and render their elevation from tier to tier, or *vice versa*, a work of difficulty, generally resulting in damage to the plants. The lighter sticks, however, carrying seven or eight plants, may be freely handed up or down by a lad.

All necessary preparations for harvesting the crop being completed, ripe plants should, weather permitting, be cut and housed without delay. It is better that this should be done "a day too soon than a day too late," which means that slight immaturity has a less prejudicial effect than over-ripeness on the quality of the cured leaf, but, as far as possible, the happy "mean" ought to be observed. That the reader may realise more fully the necessity for due care in harvesting only at the proper stage of ripeness, I would further show that plants which through any cause may have been cut in an immature condition will be more backward in curing, and have always a tendency to dry up green, while the produce does not smoke so mellow as of that which is cut at the proper time.

Over-ripe tobacco, again, cannot be cured a uniform colour, it is generally spotted or mottled. But what is more important, by being harvested too late, it has lost more or less of its potash and other valuable and necessary constituents that go towards the making of good tobacco, which, after the plant has attained ripeness, descend into the stalk, leaving a gradually impoverished leaf.

One more condition to be borne in mind before commencing the work is not to cut tobacco on a wet day, or immediately after heavy rain. Such rain will have washed some of the gum out of the leaves, and, unless overripe, one or two days' grace should be allowed them to recover this necessary constituent.

(11b143-93.)

Eragrostis lacunaria, F. v. M.

"Never Fail."

The Grasses of Australia.

(*Continued from page* 415.)

BY F. TURNER.

ERAGROSTIS LACUNARIA, *F.v.M.* "Never Fail."

Flora Austr., Vol. VII, p. 649.

STEMS slender, almost filiform, but rigid. Six inches to 1 foot, or rarely 1½ feet high, the base sometimes almost bulbous, but glabrous. Leaves very narrow, almost setaceous, usually short. Panicle loose, 2 to 5 inches long, with short, spreading, rather rigid branches. Spikelets, few on the branches, shortly pedicellate, very narrow, 3 to 6 lines long, ten to twenty-four or more flowered, terete or very slightly flattened. Flowering glumes closely appressed, broad, obtuse, scarcely ¾ of a line long, usually purple, keeled, but the lateral nerves very faint or obsolete, the rhachis scarcely articulate. Palea nearly as long. Grain ovoid or oblong, not furrowed, enclosed in the flowering glume and palea, but free from them.

This grass has the habit and inflorescence nearly of *E. chætophylla*, Steud, but with spikelets rather of *E. falcata*, Gaud. A perennial species, found in nearly all the Australian colonies, but principally on the arid plains in the interior of the continent, and in some parts very plentifully. It is to be found growing on a variety of soils, but generally more plentifully on those of a red chocolate or sandy nature. It may be easily recognised amongst other herbage by its pretty, mostly purple, panicles. Numerous specimens of this grass have been received for identification from nearly all parts of the continent, and they were mostly accompanied with notes to the effect that the plant would withstand a phenomenal amount of dry weather. On this account many stockmén call the grass "never fail." During a prolonged drought the herbage is often scanty, and rather wiry, but under more favourable conditions the stems become more flexible, and the leaves more plentiful. It is not bulky enough for a cattle run, but it is said to be a good grass to encourage on a sheep station. Sheep are said to be very fond of it, and often eat it down to the roots, even when other herbage is fairly plentiful. The "never fail" is a grass which I could recommend the florist to grow for decorative purposes. Its pretty purple panicles are far more ornamental than many dwarf exotic grasses that are at present cultivated for decorative purposes. It produces plenty of seed, which usually ripens during the summer and autumn months.

Reference to Plate.—A, spikelet; B, floret; C and D, three different views of the grain. All variously magnified.

POA CÆSPITOSA, *Forst.* "Tussock Poa."

Flora Austr., Vol. VII, p. 651.

An exceedingly variable species from under 1 foot to 3 or more feet high, usually densely tufted, and glabrous. Leaves narrow, flat, convolute or setaceous, chiefly at the base, sometimes longer than the inflorescence, sometimes very short, the ligula, always very short or obsolete. Panicle branched, compact or spreading. Spikelets usually four to six flowered. Flowering glumes usually surrounded by a few fine, woolly hairs, but sometimes the whole spikelet glabrous, the cilia of the palea-keels, when present, very minute. Grain oblong, usually narrow, enclosed in the flowering glume, and palea, but free from them.

There are several marked varieties of this exceedingly variable perennial grass. Mr. Bentham records eight. The one which I have chosen for illustration in this issue is the *Var. latifolia*, which is found in the colder parts of Australia, and principally in the mountainous regions. Until recently it has been found only in New South Wales and Victoria, but Mr. Bailey has lately recorded it from Mount Mistake, in Queensland, so it may have a wider geographical range in this country than is generally supposed. This variety attains sometimes a height of 4 feet, with leaves 2 to 3 feet long, and often more than ½ an inch wide. Panicle 8 to 11 inches long, and 7 inches or more wide. The specimen from which the drawing was made was collected on the Australian Alps, where it forms a large portion of the rich, succulent herbage of that region. Both cattle and sheep are said to be very fond of this grass, the former particularly so, and however poor they may be, provided that they are healthy when first put upon this and other mountain herbage, they soon get into excellent condition. The seeds of the broad-leaved variety of the "tussock poa" are well worth disseminating in all the colder parts and mountainous regions of this country where the plant is not already growing, and the grass is worthy of conservation where it does already exist. Judging from the bulk of herbage which it yields in an ordinary season, it is well worth taking into consideration to cultivate for silage, or for hay if cut before the flower stems are too far advanced. I can highly recommend it for trial. When this grass is allowed to grow undisturbed for a time it produces a great amount of seed, so that there would be no difficulty in the way of. collecting any quantity for dissemination in suitable situations. The seeds usually ripen during the summer and autumn months.

Mr. F. M. Bailey, F.L.S., Colonial Botanist of Queensland, speaking of this grass, says :—"This is a tall, luxuriant variety, well worthy of cultivation; its broad leaves and large panicles of flowers remind me of the guinea grass (*Panicum maximum*, Jacq.) It seems to be naturally a mountain grass, as its only known Queeensland habitat is the top of Mount Mistake range."

Reference to Plate.—A, spikelet; B, floret; C, grain (back and front views). All variously magnified.

(116143-93) Poa cæspitosa, Forst. Var. latifolia.

"Tussock Poa."

New Commercial Crops for New South Wales.

(*Continued from page* 419.)

By F. TURNER.

The Cultivation and Uses of the "Caper Bush." (*Capparis spinosa*, Linn.)

It was thought advisable to figure and describe the caper plant of commerce in the *Agricultural Gazette*, so that no mistake could possibly occur in correctly identifying it. During the past few months specimens of a plant known to botanists as *Euphorbia lathyris*, Linn., and commonly known as the "caper spurge," have been forwarded to this Department for identification by a number of persons who called the fruits "capers," thinking, of course, they were the commercial article of that name. In some instances information was asked for as to the best means of pickling them. In other cases it was stated that persons had experienced severe burning sensations in the throat after eating some, and not a few children were taken ill in consequence of having partaken of the fruit. The "caper spurge" is cultivated in many gardens, and in some instances the plant is growing as an escapee from cultivation. A common description of this plant is given in the *Agricultural Gazette*, vol. IV., page 215.

The caper plant of commerce is indigenous to Southern Europe, to the Mediterranean region, to India, and also to some of the Australian Colonies. The typical species grows into a shrub of from 3 to 4 or more feet high, with numerous slender branches, bearing a pair of short hooked spines at the base of each leaf stalk. Leaves alternate, ovate, or nearly orbicular, thick, and often shining. Flowers about 2 inches in diameter, white, tinged with red on the outside, solitary, on rather long stalks, arising from the axils of the leaves. The fruit is ovoid, and marked with longitudinal ribs. The seeds are kidney-shaped, and of a greyish-brown colour. Apart from the economic value of this shrub, it is, when in flower, a beautiful sight, and, from an ornamental point of view, should find a place in every garden. In Europe there is a variety of the caper plant without spines, and it is said to reproduce itself true from seed.

About 120 species of the genus *Capparis* have been found and recorded from different parts of the world, but principally in tropical and sub-tropical regions. The fruits of some species are of great economic value, as affording an important article of food to the inhabitants in those countries to which they are indigenous. About sixteen species are found in Australia, and they are fairly well distributed over the continent, from the coast to the arid interior. At one time the fruits of many of these plants formed an important article of food to the aborigines. The ripe fruits of *Capparis sarmentosa*, A. Cunn., are very delicious, as also are those of several other species I have eaten.

Capparis mitchelli, Lindl., is commonly called the "native orange." It grows into a tree with a spreading head of dense foliage, and bears a rough, globular fruit, about 2 inches in diameter, the pulp of which is eaten by the blacks. The Hon. Dr. Norton, M.L.C., informed me that when travelling in the interior of New South Wales some years ago, this tree, which was then in full bloom, was the most beautiful object he saw in that then drought-stricken portion of the continent. This very ornamental tree is well worth cultivating in gardens, but should only be planted in a well-drained soil.

Capparis nobilis, F.v.M., commonly called the "native pomegranate," is a coastal tree, which I have seen growing about 25 feet high. It bears a globular fruit, from 1 inch to 2 inches in diameter, the pulp of which is eaten by the blacks. This is also a very ornamental tree, which is worthy of place in any garden in the coastal districts. The fruits of *Capparis canescens*, Banks, are often called "native dates." Most of the other Australian species of *Capparis* are of shrubby habit, and many of them are worth cultivating, either for their beautiful and often singular-looking flowers, or for their delicious pulpy fruits.

The caper plant of commerce would grow nearly all over New South Wales where the soil and situation are suitable, and in places were the winters are not too severe. It will bear a few degrees of frost without injury, provided the situation is a dry one. Some years ago a few fine caper bushes grew in the Brisbane Botanic Gardens. I planted these in a very dry sandy soil, having a north-easterly aspect that was exposed to the full force of a sub-tropical sun. Mr. W. Hill, then director of those gardens, had some capers prepared for the Botanic Museum. The caper bush is capable of enduring a phenomenal amount of dry weather, and will even flourish on land that is unsuited for most other kinds of economic plants; it might, therefore, be very well planted on rather stony hill-sides, or on gently sloping but rough embankments, thus utilising land that is practically lying idle from an agriculturist's point of view. It is said that the caper bush is more productive when grown on calcareous clays than on any other kind of soil, but of this I have had no experience. Whatever may be the nature of the soil that is chosen for the caper bush to grow on, it must be broken up where practicable, and be thoroughly drained if not naturally so situated, and be fully exposed to sun and air. Nothing, in my experience, injures the plant more than stagnant moisture and shade.

Propagation.

The caper bush can be propagated by suckers, by cuttings, and from seed. The latter is the most natural, and, of course, a very simple and expeditious way of raising the plants. The seed should be sown in August in places where it is intended to grow the plants permanently, or in extemporised shallow boxes, the seedlings to be afterwards transplanted to their permanent situations. If it is decided to raise the plants in shallow boxes, and these should have tight-fitting sides and bottom, a few holes should be made with an augur, so that any superfluous moisture may drain out quickly. Two or three inches of rather coarse cinders or charcoal should be placed at the bottom of each box to act as drainage. Over this place a thin layer of half-rotten leaves to prevent the soil interfering with the efficiency of the drainage, then fill up nearly to the top of the box with some light open soil, press it firmly down, finally leaving it about 1 inch from the top; on this sow the seeds thinly and evenly, and only slightly cover them with soil; set the boxes in an open situation, where the seedlings will have the benefit of plenty of sun-

light, and do not water the young plants too liberally. With ordinary care seedlings raised in this way will be ready for transplanting in about twelve months after the seed is sown. In sowing the seeds, where it is intended that the bushes are to grow permanently, two or three should be planted together, and when the seedlings are about 6 inches high, thin them out, leaving the strongest plant at each place to develop into a bush. Cuttings can be struck in sand under a hand-glass, but to be very successful it requires the skill and attention of a professional gardener; therefore, I would not recommend any farmer to attempt this mode of propagation. From near the base of established bushes suckers are often formed, and in the spring of the year these can be severed from the parent plant, and be successfully transplanted to their permanent quarters, provided that each sucker is well rooted before performing the operation.

Planting.

The best time to plant the caper bush is in August or September, according to situation, and also on the state of the weather, which should not be too wet. Where it is intended to grow the caper on a commercial scale, the bushes should be planted quincunx in rows 5 feet apart, and 5 feet distant from each other. At this calculation it will take about 1,742 plants to the acre. When they are set out in this way, the produce will be more easily gathered than if planted on any other plan, and it will also facilitate what cultivation may be required. The only work in this direction will consist in keeping down weeds and other undergrowths, more especially whilst the plants are young. The caper bush will require some attention in the way of pruning, but this will chiefly consist in cutting well back the too straggling growths in winter, so that the plants may present a fairly even appearance. Under ordinary conditions the caper bush will begin to flower the second year after planting, but after the fourth year good annual crops of buds can be gathered for pickling, and fruits, if desired for eating. The above is written from a colonial experience point of view.

Vilmorin says, "The caper-bush can only be cultivated profitably in the climate of the olive-tree, where it is almost always planted in dry stony places—on embankments, declivities, and other positions which are difficult to utilise in any other way. In some of our colonies it could be easily grown. The flower is very beautiful and distinct, especially to those not familiar with it, in countries where it grows freely. Under the name of "capers" the flower-buds, gathered when they are as large as peas, are pickled in vinegar. They are much used in cookery, and are valued in proportion to the smallness of their size."

Le Maout and Decaisne say:—"Among the *Capparideæ* with fleshy fruit, *Capparis spinosa* must rank first. It is a shrub of the Mediterranean region, the bitter, acrid, and astringent bark of whose root has been esteemed from the most ancient times for its aperient and diuretic qualities. The flower-buds, preserved in salt and vinegar, are known as capers, and are much used as a condiment."

The Treasury of Botany, speaking of the genus *Capparis*, says:—"The most generally known plant of this genus is the common caper (*C. spinosa*), which grows on walls, &c., in the south of Europe and Mediterranean regions. In its mode of growth it resembles the common bramble. The flower-buds, and in some parts of Italy the unripe fruits, are pickled in vinegar, and form what are commonly known as capers. They are chiefly imported from Sicily, though the plant is also largely cultivated in some parts of France."

Masters, quoted by Baron Von Mueller, says:—"The buds, after their first immersion in slightly salted vinegar, are strained, and afterwards preserved in bottles with fresh vinegar. In the sheltered plains of Provence annually about 1,760,000 lb., worth at an average of 7d. per lb., are collected. The shrub comes into full bearing at the fifth year, the harvest continuing well for many years afterwards."

The following particulars are from Dr. Watt's *Dictionary of Economic Products of India*:—"In India the ripe fruit of the caper is either eaten raw or made into pickle. In Sind and in some parts of the Panjáb, a compound of oil, mustard, fenugreek, &c., is used in pickling capers. In Ladak the leaves are eaten as greens."

Fodder.—"The leaves and ripe fruits constitute a favourite food of goats and sheep."

Chemical composition.—The root bark is said to contain a neutral bitter principle of sharp irritating taste, and resembling senegin. The flower-buds, distilled with water, yield a distillate, having an alliaceous odour. After they have been washed with cold water, hot water extracts from them capric acid (C_{10} H_{20} O_2), and a gelatinous substance of the Pectin group; capric acid is sometimes found deposited on the calices of the buds in white specks, having the appearance of wax.—(*Rochleder and Blas*, Watt's Dict., Chemistry.)

The following extract from *Rural Cyclopædia* shows the method of cultivating the caper (*C. spinosa*) in the following countries:—"This species is cultivated in Spain, Italy, Sicily, and the south and centre of France, for supplying the market with capers, and it requires little care, and is of very easy management. In autumn, the stems of the plants are cut down to within 6 inches of the ground, and are covered all over with soil from the intermediate spaces; and in spring, they are uncovered and trimmed, and are dressed and earthed up with soil to the points at which the new shoots are likely to be produced. In the latter part of the spring they begin to bear flower-buds, and during the whole season, till the restraining of the flow of sap, or throughout a period of about six months, they continue to yield an unintermitted series of buds. A gathering of buds is made every morning, and immediately thrown into a tub of vinegar; gathering after gathering, throughout the season is thrown into the same tub; and a little common salt is dissolved in the vinegar, in order to prevent bad effects from a diluting of it with the watery portion of the buds. At the end of the season, caper merchants, who travel through the country for the purpose, purchase the accumulations of gatherings in the tubs, and partly by sifting through sieves, partly by testing the quality of the vinegar, divide them into two sorts. The smallest are the most highly esteemed; the next in size are the next in esteem; three other sizes are of gradually decreasing value; and all the fine sizes are completely separated from one another, disposed for sale in five distinct sets of bottles, jars, and barrels, and named respectively the Nonpareil, the Capucine, the Capote, the Secondes, and the Tierces."

NOTE.—The caper-plant of commerce grows well in the vicinity of Sydney, and has done so for years. Sir Wm. McArthur introduced it to Camden Park very many years ago, and it succeeded there admirably. I grew it with great success within a few miles of Sydney, and can highly recommend it, not only as an ornamental plant, but for use for domestic purposes.—ED.

Reference to Plate.—The plant was drawn from a figure by Vilmorin, and the details after Le Maout and Decaisne. A, flower; B, flower, cut vertically; C, fruit; D, transverse section of fruit; E, seed.

Capparis spinosa, Linn.

"Caper Bush."

(116143-93.)

Notes on Economic Plants.

A VERY great deal of interest has been taken in the "Australian Nut"* since it was figured and described in Part I, Vol. IV, of the *Agricultural Gazette.* The article and also the illustration have been republished in a number of Australian journals.

Dr. Joseph Bancroft, of Brisbane, who is so well known in Australia for the great practical interest he takes in economic botany, made the following remarks with regard to this nut, in a letter which Mr. Turner received from him. "Some years ago I planted two trees at Kelvin Grove. Both give an immense crop of nuts every year, and some hang on for months. and give nuts the greater part of the year. If struck carefully with a knife and mallet on the small spot and along the furrow the two halves separate as when the seed bursts them. If warmed a little on the fire-range the kernels shrink a little and then fall out readily. They should be brought to table so prepared. When one finds such splendid yields from trees of 10 to 20 years old one regrets not to have planted more."

Dr. Bancroft also wrote the following interesting remarks with regard to the "Vigna" or "Catiang bean," a figure and description of which appeared in Part II, Vol. III, *Agricultural Gazette.* "When mature I had them cut with a sickle and baled up and sent to town by train. We chaff up all together for the horses, beans, stalks, and leaves. The horses fatten on them, and I believe do better than with maize.

"The white-seeded variety with buff eye is here the best bean and is good human food. This will prove to be the best summer bean for the coast country. It is much injured by a weevil and is best kept for seed in the shells."

* NOTE.—The "Australian Nut" better known as the "Queensland Nut" grows with great freedom in the Botanic Gardens, Sydney, where some fine specimen trees produce nuts freely, and also in many suburban gardens. Nuts for sowing should be obtained as fresh as possible, otherwise they are unlikely to germinate. They must not be buried deep in the ground. If just pressed into the surface, and covered with leaf mould, or even moist dead leaves, they are most likely to succeed.—ED.

Report on the Grazing Leases of the Mount Kosciusko Plateau.

By R. HELMS,
Department of Agriculture.

It may be said that the Kosciusko Plateau forms an almost rectangular triangle. With its right-angle at Pretty Point, one side extending along the Ramshead Range for 12 miles in a S.W. direction to the point where its highest peak gives this range the name, then turning in a N. by E. direction along the Snowy Range for 15 miles the longest side is formed, and from this point a line continued for 9 miles in a S.E. direction will reach Pretty Point, and make the third line of this triangle.

From Pretty Point, which is about 5,700 feet above sea-level, the country rises very gradually, more or less undulating and interrupted by low ranges, towards the Snowy Range, where an average height of 6,500 feet is reached, with some of its most elevated peaks up to over 7,000 feet. None of the ranges are inaccessible or very abrupt, and in but few instances rise over 500 feet above the intermediate valleys; in fact, the low elevations and gentle sloping valleys with their extensive flats are characteristic of this part of the country, and therefore it may fairly be called a "plateau," although in the strict sense of the word this term may not be applicable.

The area of this highland comprises about 38,000 acres, the greatest part of which is splendid grazing country and covered on the open parts with a dense coating of grass, assuming in many places a carpet-like compactness. The most of the ridges are more or less covered with stunted arborescent growth and scrub, and on the flats in many places small peat bogs are formed; but the slopes, and more particularly those of the Snowy Range, are covered with a very nutritious sweet grassy sward interspersed with succulent mountain herbage, all equally greedily eaten by horses, cattle, and sheep.

Near the elevation of 6,000 feet the arborescent growth ceases and only occasionally small patches of *Eucalyptus gunni*, Hook., are met with and also the low growths of *Eriostemon obovalis*, *Prostanthera cuneata*, *Epacris petrophila*, *Bossiæa foliosa*, and a few other similar shrubs appear here and there on the slopes in dense patches.

Besides the area of the plateau, which is the choicest part of the country, a good deal more land has lately been surveyed adjacent to it, the whole of which comprises 81,000 acres, and is divided into twenty-two "snow leases." The land being yearly covered for months with snow has no doubt given rise to this term; but for five months of the year, viz., from early in November till the end of March, the pasture is in excellent condition, and during this time herds of cattle and sheep are depastured upon it when food is getting dried up on low-lying plains.

There is always an abundance of the purest water to be found throughout the district, fed from the accumulations of snow that remain even into the height of summer, and, hanging on the south-eastern slopes of the highest peaks, rarely disappear entirely. Particularly during times of drought this pasturage is very valuable and the leases would be readily let but for the rather high rental and the surveying expense, which is considerable. I have, however, been informed that last year similar leases near Kiandra were let at a rental of 9d. per acre, which is above the upset price.

The highest slopes of the Snowy Range are the most favourable parts for sheep, on account of their drier nature and freedom from scrub. The abundance of feed found everywhere soon puts stock in good condition, because they do not require to travel over much ground. Besides, on the eastern slopes, they often find shelter in the high growing patches of *Danthonia robusta*, a grass much liked in spite of its coarseness, and which grows tall enough to hide them completely.

The valleys and flats in many places are rather boggy for sheep, and are, therefore, better adapted for cattle which everywhere do remarkably well and soon put on condition.

A great number of unowned horses are found all over the ranges. These must often have hard times of it during the winter, when snow covers the ground, and the bones of some, particularly those of young and inexperienced animals that failed to escape in time to sheltered valleys, and succumbed, may be found in places. Sheep, also, that are not mustered at the end of the season will generally die of starvation.

The weather in these ranges, as in most elevated places, is at times very changeable, and frosty nights often follow warm days. Fogs are of frequent occurrence, and even snow-storms may pass over the heights at any time during the early part of the summer. This is often hard upon sheep when they are first brought up from a warmer district, having but a thin fleece, and some of the weak individuals may be killed; but on the whole, when once acclimatised, they do remarkably well.

Up to the present time the ranges have been, so to say, a free country, and anyone who liked took stock up there. This, of course, will not be so when the country is leased. A common, and, in my opinion, very improvident practice, will probably be continued as hitherto, viz., the constant burning of the forest and scrubs. This proceeding has only a temporarily beneficial effect in regard to the improvement of the pasture by the springing up of young grass in the places so cleared, for after a year or two the scrub and underwood spring up more densely than ever. On the very high slopes the dense low scrub, consisting of the plants mentioned above, which in common phraseology go by the name of *heathers*, certainly do not reappear quite so readily, on account of their slower growth, and in places when the burning is done with discretion a permanent improvement may be effected by the removal of them in this way; however, I have seen some very detrimental effects from this practice here, because the heavy rains wash the soil away from the steep declivities, and it is either carried into the creeks and rivers and entirely lost, or it accumulates in the boggy places, and thus become useless. The more or less constant diminution of humus in the soil of the slopes is a danger not generally recognised.

Cane Disease and Cane from Seed.

THAT the visitation generally known as "Cane Disease" is not confined to the sugar districts of New South Wales is evident from the writings of experts in all parts of the world where sugar-cane is cultivated. As in this country, many causes are given for the deterioration in the cane plants, but an article which has been reproduced in the April number of the *Louisiana Planter*, being a translation of an article by M. Raoul in *Le Courrier de la Guadeloupe*, appears particularly worthy of note. From time to time investigations have been made by authorities in this country, and in the majority of cases their reports have practically proved that there is a general deterioration of cane attributed, among other causes, to the present system of reproduction. Many recommendations have been made with a view to improvements in this respect which doubtless are excellent so far as they go, but M. Raoul would appear to go a step further, and, as will be seen from the following extracts from his article, to have very strong reasons for the ground which he takes up.

While bringing forward the article in question as a considerable factor in the process of improved sugar production, we desire it to be distinctly understood that the question as to soil exhaustion still remains unsettled. We still consider that so long as there is an absence of rotation or of necessary manuring, deterioration will continue to a greater or less extent, although probably the appearance of the so-called "disease" may not become so rapidly noticeable. The joint causes, no doubt, are answerable for the present condition of affairs, and it will be by means of the intelligent application of combined remedies that any well-defined improvements will take place.

In order best to explain the position taken up by M. Raoul, we reproduce the following paragraphs from his article:—

"The cane, like the vine, has always enemies, but there are no diseases, nor even parasites, that destroy them when they are cultivated as they should be, and in their own normal habitat. Some words are necessary to combat these beliefs and to account for them, which, in my opinion, we must assume in discussing the multiplication of the vegetable species. The natural reproduction of a vegetable is through the seed, under whatever form it is developed. In addition to this natural mode of reproduction, and the equally natural mode of reproduction by stolons, tubercles, &c., all other methods practised by man are artificial, against nature, and full of danger. If this mode of artificial reproduction is exercised on a plant with a single stalk, developing neither shoots, stolons, nor tubers, which produce a new plant, the difficulties are reduced, and may not appear perhaps for thousands of years—that is to say, they are perhaps hypothetical.

"But if the vegetable periodically mutilated develops a seed tassel; if this ablation of the stock does not kill the mother stalk, but determines only the formation of a new shoot, destined to replace the mother stalk; if the future needs of man lead to the frequent repetition of these operations, let us see what results.

"The stalk leaves are the organs which liberate and preserve the nourishing juices for the growth of the roots, tubers, &c. In cutting the stalk this food reserved for the roots is abolished, and this portion of the plant finds itself in identical conditions with those of the organisation of an animal that one nourishes very highly in order to obtain from it methodically every day the quantity of blood furnished by its organs already developed by intensive feeding.

"Further, by cultivating a plant out of its habitat, there results with it a modification analogous to a condition of equatorial anæmia, which is so easy to produce in Europeans by a sojourn of some years within the equatorial zone. It is under these conditions of pathological receptivity, produced by one of two causes, continual transmissions by heredity, and not by parasite, which is but the result, whereon we must place the real cause of all parasitic affections of vegetables. Cultivators of canes and vines have arrived, without desiring it, at a condition produced in animals by analogous treatment, with this aggravation, that there has never been any termination in the continuity of the practice, and the modification of the roots thus obtained has never been lost, since the reproduction by cuttings perpetuates the evil. There have thus been created through some centuries varieties of vines and canes with roots relatively feeble."

One of the effects of this gradual modification has been, says M. Raoul, "the provision of edible roots for the beetles and insects which live in the soil. . . . The insects, provided with a large subsistence, have multiplied like weeds, and by the destruction of the essential organs of the plant have brought about the various conditions described thus far under the name of cane sickness, vine sickness, sereh, phylloxera, &c., under which the attack and destruction of the root is the cause of the death of the plant. All the world, as I have many times said, demonstrates experimentally the truth of this theory. In the midst of a cane-field destroyed by a parasitic affection of the roots, plant a spontaneous cane. You will see it vegetate perfectly in the midst of a yellow shrivelling field."

The remainder of the article consists practically of data upon which Mr. Raoul bases his deductions. Without going into these, it may be mentioned that they disclose circumstances remarkably similar to those existing on our northern rivers, and moreover, they include the result of a careful investigation, proving that if animals or plants are transported to a climate to which they are not adapted, at the end of generations they are stricken in the organs necessary for the reproduction of the species.

We now come to a definite point, reached by M. Raoul, on what is evidently a fair line of argument:—"Cane reproduction by means of cuttings is unnatural, and the only natural mode is by seed." This brings us to a question which for some years past has been a theme of interest in every sugar-producing country. As far back as July, 1891,* we published a paragraph from the *Revue Agricole* (Mauritius), announcing a successful attempt by Mr. A. Daruty de Grandpré to raise sugar-cane from seeds. Since this time there have been many others equally successful, wherein the experiment has been not only more extensive, but carried to a degree which tends to bring this mode of reproduction more within the scope of commerce.

Dr. W. T. Thistleton Dyer, Director of the Royal Botanic Gardens, Kew (England), writing on this subject, says:—"Since the time of the rediscovery, at Dodd's Botanical Station, Barbados, of the seminal fertility of the cane was authenticated, realising its potential importance, a sys-

* Vol. II, page 428.

tematic experimental work has been carried on at our own Botanic Gardens, as our columns have before disclosed. That the very earliest varieties of sugar-cane can reach maturity the first year of their growth from seed has been shown as possible under favourable circumstances this season at the Botanic Gardens, though it must be admitted that even with these very early varieties, both the proportion of canes in a stool, and of plants to a bed of the same variety, which flower the first year, is small. Seed of the variety "Karakarawa," which is one of the two earliest kinds in the Colony, was sown on the 1st October, last year. Three months later the young plants were taken from the seed boxes and pricked out in a basket, five or six in each basket. Six weeks later again they were shifted singly into larger baskets, which were about 6 inches deep and wide, and in which they remained till they were from 1 to 1½ feet high, when, on the 19th April last, they were planted out in the open ground. At that time each plant consisted of a solitary shoot, none having begun to sprout from the base. A few weeks later, however, they began to tiller freely, and to grow rapidly, and by the middle of September the more advanced plants were in flower, thus completing the cycle of growth. As when they were planted out in the ground in April, the young plants were only in an equivalent stage to that of a cane top put into the ground at the same time, the record above given shows that seedling sugar-canes of the earlier varieties make rapid and vigorous growth once they get past the tedious period of infancy, which occupies from four to six months. Only, however, the very earliest varieties mature the first year, all the rest, though they may be only a month or so later in their period of flowering, miss the first season of arrowing, and consequently have to go on to the following autumn before the chance of performing that function occurs again; so that, for the great majority of varieties, it may be said that two years are required from the time the seed was sown for the seedlings to mature, or from fifteen to eighteen months from the time they were strong enough to be planted out in the open ground."

The next experiment which we reproduce in full from *The Planters' Monthly* for April, 1893, is that which deals with the matter on a larger and more commercial basis. It will be seen that the necessity for selection, as in the case of all seedlings, is fully recognised in this instance, and the plan adopted is one well worth imitation by New South Wales cane planters:—

"We have on various occasions presented to our readers accounts of experiments in the reproduction of cane from seeds made by two of our most skilful cultivators, Messrs. Littee Freres, on their estate at Parnasse. We are now glad to be able to furnish particulars of extremely encouraging results obtained by these gentlemen.

"Before entering on the scientifically accurate details which we find in the documents communicated to us, we will just remind our readers of the manner of procedure adopted by Messrs. Littee Freres.

"The observations which we are considering refer to two categories of canes descended from seed; one being young plants sprung spontaneously in *1889*, and found by the observers in consequence of indications given in this journal; the other having come from sowings made in 1890, and been carefully tended from the earliest stage of growth.

"The parentage of some of these is unknown. Of others, the origin is partly known, the variety from which they proceeded having been noted. Messrs. Littee have not pursued a purely scientific object; they have not gone in for growing this or that kind of canes. On their estates are cultivated only the best kinds of cane, which have been recognised as such after

a long course of successive selections. In common with those in our hemisphere who have discovered the seminal fertility of the cane, and for six years have been devoting themselves to the study of this new science, they thought that the spontaneous products of the best kinds offered every chance of giving the best results, and have left to chance the care of fertilising the flowers, trusting to their sagacity and their long practice to discover when the time had come, the finest specimens, and to separate them from the ordinary ones. At the same time they noted the variety from which the seeds sown by themselves had been obtained.

"They have not been deceived in their calculations, and experience has shown that the same thing had happened elsewhere, and Messrs. Harrison and Jenman, in a very voluminous report on this subject published in 1891, express themselves as follows on the point:—

"'There is no proof that the chances are not equal, or even greater, of finding a new greatly improved cane by natural production, left to the care of chance. Incomparably the most marked progress at present achieved has been realised by heterogeneous wild canes, of unknown paternity, gathered in the fields of Barbados.'

"Having said this much we will allow the documents to speak which have been communicated to us. The first of these documents is a letter of Messrs. Littee to M. Rouf, accompanying samples of cane sent to that skilful chemist for analysis. This letter is dated 28th October, 1892, and runs as follows:—

"'This sample, and those which follow it, come from our sowings of seed commenced on the 12th November, 1890; the plants which have sprung from these seeds were turned out of the pots and planted in the ground in May and June, 1891, to the number of about 4,000, on a superficies of one carre (1·29½ hectare=3¼ acres). As you see, they were planted wide apart, They have been manured with farm-yard manure, and had two months afterwards a dose of 60 grammes of your fertilisers S. P. R.

"'It is therefore about twenty-three and one half months since these cane were sown, and seventeen months since they were planted out.

"'At the time of the cyclone they had attained a certain amount of development, and were completely ruined, so that we had doubts of being able to save them. Happily they had got through this first trial, and if it had not been for the worms, and for what people have agreed to call the *cane sickness*—to whatever cause it may be due—by which they have been specially attacked, they would certainly have done better. Anyway, the plot of land, on the whole, has produced a lot of canes, and now these have been cut, there remains on the stumps a large quantity of cuttings of all sizes, so that we have let them stand for another crop.

"'We shall inform you of the final result, in litres of juice, of the whole plot, compared with what it habitually gives in canes planted in the usual manner.'

"A letter of the 22nd November gives the comparative yields promised in the preceding one. The same plot gave:—

In 1892	... ...	43,103 litres of juice.
In 1888	... ...	65,008 ,,
In 1882	... ...	42,703 ,,
In 1877	... ...	58,955 ,,

"'While falling below the yields of 1888 and 1877, it slightly exceeded that of 1882, which might have been affected by various adverse circumstances, but certainly had not to suffer from the effects of a cyclone, nor yet at that time of any disease whatever.'

"Such is the net result, and we may say with Messrs. Littee that 'there is not very much to complain of,' especially when we consider that the general yield of the canes affected by the cyclone was inferior in 1892 by half.

"But in the lot, as a whole, there were both splendid canes and abortions; and the task is to distinguish and pick out the former and destroy the latter. It is to this practical selection that Messrs. Littee are now devoting themselves, guided. in their labours by the analysis of M. Rouf, and we may add that no one is more fitted to bring this delicate task to a good end.

"From the 4,000 canes planted on the one carre of ground, Messrs. Littee took a certain number of samples which seemed to them the most noteworthy. Six of these samples were analysed by M. Rouf.

"Four of these samples, Nos. 12, 13, 14, 15, came from seedlings; two are from shoots from canes found springing up spontaneously in 1889, from which a previous crop had been taken. These are Nos. 7 and 10. On coming to classify these six samples in order of extractible sugar, we see that there are, per stool:—

Of Extractible sugar.

No.	kilos.	pounds.
15	19,473	42,838
10	13,237	29,187
7	11,104	24,484
12	9,827	21,668
14	7,027	17,258
13	3,746	8,260

"Nos. 15, 7 and 10 are, therefore, very remarkable varieties; Nos. 12 and 14 are somewhat poorer, but they are superior to the canes which we are at present cultivating, for a carre, planted with canes such as No. 12, would give 39,308 kilos (86,674 pounds) of extractible sugar, and with canes of No. 7 (*sic*) quality, 28,108 kilos (61,978 pounds.)

"Sample No. 13, the poorest, would still surpass our first-class cane, with a yield of 14,984 kilos (33,040 pounds) of extractible sugar per carre.

"If we make similar calculations for Nos. 15 and 10, we shall get formidable figures.

"The cane No. 15 gave, per stool, a weight of 311 pounds of cane, and 43 pounds of extractible sugar; with 4,000 plants of cane to the carre, this would mean a production of 1,244 pounds of cane and 192 pounds of extractible sugar. The cane No. 10 would yield 968 pounds of cane and 117 pounds of extractible sugar, and the cane No. 7, 894 pounds and 104 pounds respectively.

"It is, of course, understood that we may have only drawn up these figures as a matter of curiosity, and that we do not for an instant cherish the hope of seeing such results verified in practice. We know what is the difference between a cane plant which has sprung up under all the most favourable circumstances, whether due to the care of man or to chance, and a field of canes exposed to the vicissitudes of actual vegetation. But as we have recorded the incredible retrogressions which have been met with in these experiments, and described a cane raised from seed hardly as big as a plant of guinea grass, so we now tell of exceptions in the contrary sense.

"These extraordinary canes can be fixed as species by means of cuttings. This is what Messrs. Littee have done, and we may imagine the care that has been taken with these plants If they only preserve even a portion of their original properties, the margin is so great that we may hope to see obtained from them a greatly improved cane, perhaps a means of salvation for the

industry. However, that may be, we are fully warranted in characterising the results obtained by Messrs. Littee as very remarkable and exceedingly encouraging, and congratulate them warmly on their success."

We have also received a report on a stool of cane raised from seed by Mr. Samson of the Colonial Sugar Refining Company's mill at Harwood. In this report Mr. O'Kelly says "it is at the present time a very fine specimen of the *Rappœ* variety. It is, I believe, about eighteen months old, and has now about 4 feet of crushable cane on it, and has stooled out very well. It possesses all the physical and morphological characteristics of the parent stock, but shows a marked tendency to improvement. Over 100 cuttings will be available from this plant for planting this season, and the following year sufficient cuttings for several acres will be the result."

In Dr. Watts' "*Dictionary of the Economic Products of India,*" Vol. VI, Part II (1893), there is a record of several instances of the germination of cane-seeds in India, although considerable difficulty exists in that country in getting supplies of cane-seeds, "owing to the strong prejudices of the people" to the flowering of cane. "It need," says Dr. Watt, "be only repeated by way of conclusion that the practical interest in the subject of the seeding of the cane lies in the possibility of producing improved sugar-yielding forms. It is admitted by all sugar-cane planters that continued propagation from cuttings grown, year after year, on the same soil, results in serious degeneration. On this account planters at a distance periodically exchange seed-canes, or special nurseries are resorted to for the purpose of producing seed-canes. The same fact is fully appreciated by the native cultivators of India, and the dangers of too continuous a cultivation of any particular form are quite understood. Thus, for example, a native cultivator wrote in the Agri.-Horticultural Society's journal, on the destruction of the red Bombay canes of Bengal. This was due to the appearance of a worm in the cane after it had been grown in the same district without intermission for a great number of years. Fresh stock grown side by side remained free from disease. It seems highly probable that the degeneration of the imported canes was largely due to the same cause, and that nurseries for interchanging stock from one province to another, or from district to district, would therefore effect greater improvements in the Indian sugar industry than anything else that could for some time to come be undertaken."

The chief importance of the above extract, apart from its confirmation of the necessity for seedling canes, would appear to lie in the suggestion as regards the establishment of nurseries where seedlings could be grown, selected, and exchanged.

In view of inquiries which have already been made, and will naturally arise as this matter comes in a practical form before our cane planters, we reproduce a description of Mr. Daruty de Grandpré's method of obtaining and planting the seeds of cane:—

"After the cane has arrowed, and is in full bloom, a piece of thin muslin is taken and thrown over the flower and tied to the stem, so as to prevent the loss, and catch every spikelet that may fall from the flower. This is left there until the flower is well matured; then the panicles are gathered, and as the seed does not separate easily from the glumes, and cannot be discerned by the naked sight, all the material is rubbed off the panicle, and the muslin first mentioned. Boxes are prepared with very small holes perforated in the bottom, and filled with loamy soil. The sowing is made, and placed in sufficient shelter, but the material is so light that care is taken, only using the hand to press it a little, but no soil must bé used to cover it, for the seeds are so delicate that if covered they cannot penetrate

through to the surface, and to water them the boxes are dipped in water until sufficient moisture has reached the surface of the soil. Apparently not more than two or three spikelets among a hundred are fertile. The seed takes from a week to a fortnight to germinate, and must be sown freshly gathered, for the vitality is very fugacious. During the first three months the plants are very slow, and resemble very much buffalo grass, after which they grow very rapidly, and can be planted in the ground in six or seven months."

In order to show the unanimity of the results obtained by experiments in various parts of the world, we add the following further extract from Mr. Daruty de Grandpré :—

"The canes thus produced are very thin, but by replanting these stalks in the present way the result is very good—the cane large, healthy, and of different variety. The chief duties of the future will be raising, testing, and selecting the new cane stocks, with the object of obtaining varieties superior to any now in cultivation; consequently, by chemically analysing, and with a careful growth, side by side, will come to a conclusion."

National Prize Competition, 1892.

Mixed Farms.—Western Plains District.

G. GODFREY, Judge.

I now have the honor to submit for the approval of the Minister detailed reports and awards in connection with the mixed farms in the western plains district entered for the National Prize Competition of 1892.

The farms entered were eleven in number, situated at Moama, Jerilderie, Forbes, Berrigan, Coonabarabran, Deniliquin, and Young, and over and above the railway journeys I was compelled to travel upwards 650 miles by road.

Generally speaking the entries were quite up to the average, and in the cases where prizes have been awarded the farmers show signs of exceptional knowledge and energy. Naturally in visiting so many different portions of such an extensive district one could not help noticing many matters of general interest to farmers. The most noticeable fact is the success which attends the farmers who combine sheep and wheat farming. In almost every instance where the system is followed the beneficial results are apparent in comfortable and even luxurious homesteads and handsome annual returns. There are, of course, differences in the methods followed which vary not only with the surrounding circumstances, but also with the ideas of different farmers. Thus it will be seen on reference to my report on the farm of Mr. Anderson, of Altcar, that this gentleman has achieved great success by the intelligent sowing of part of his fallow land in September, with rape. The rape, in addition to forming an excellent change crop, is utilised for feeding sheep. The beneficial effects of this method are observable in many ways, such as keeping the ground free from weeds, providing a heavy manuring from the sheep droppings, and, what is probably most remarkable, little or no rust occurs amongst wheat grown after rape treated in this manner. Then again, some farmers use lucerne as a change crop, feeding it green to the sheep and also preserving some in stacks for winter use. This plan is, however, in the experimental stage and no reliable details were obtainable regarding its success financially.

The absence of the necessity for underground drainage was another fact which struck me very forcibly. This is a point greatly to the advantage of a farmer and, combined with the generally rich soil to be found in the district, renders the occupation of land for farming purposes peculiarly profitable.

I was pleased to find that the practice of working a garden and orchard to supply home requirements is very general, and in some instances a fair return is obtained by the sale locally of vegetables and fruit. Large numbers of vines are being planted, and in the case of one competitor about 3 acres has just been planted under raisin grapes. In no instance, however, were the vines of sufficient standing to obtain any reliable estimate as to returns.

The serious losses inflicted on farmers by bush fires have led to precautionary measures being very general. In some instances crops of wheat are secured by cutting a chain wide round the fences for hay, and afterwards ploughing the space and leaving the balance of the crop to come to maturity. Some plough a chain wide outside the fences, while others again adopt the double precaution.

I feel that my duties would be incomplete without a slight suggestive reference to matters which my visits have shown could be easily and advantageously improved upon. Every farmer running a quantity of stock must have a certain percentage of deaths, and I would suggest that in all such cases the bones should be saved and utilised for manurial purposes in the manner pointed out in the *Agricultural Gazette*, vol. III, page 466. On farms where the areas are so extensive as those under consideration, I would suggest also that more attention should be given to poultry raising. Not only is this a ready source of revenue, but it affords a pleasant change of diet which is much wanted in the bush. I am aware that many farmers give as a reason for the small quantity of poultry kept that they do so much damage. My own experience, however, enables me to state that any damage they may do is more than counterbalanced by the quick and satisfactory return, both in eggs and market birds, and I would strongly recommend all farmers to pay this matter a little more attention.

There is a matter which I think it advisable to call attention to as affecting the present system of awarding points in connection with the National Prize Competition. One of the necessary inquiries relates to income and expenditure, and I cannot help feeling that farmers, although they supply the information, feel that the publication of detailed figures is hardly fair to them. If I may be allowed to do so, I would respectfully suggest that only the totals be published and in that event I feel sure that the competitors would be willing to go more fully into figures with the judge to enable him to certify to their correctness.

In conclusion I have the honor to recommend the following awards to the favourable consideration of the Minister:—

First Prize.—Wm. Anderson, Pine Hill, Altcar, Moama.

Second Prize.—Chas. M'Allister, Murray Hut, Jerilderie.

Third Prize.—Messrs. N. A. Gatenby & Co., Jemalong, Forbes.

Highly Commended.—S. Nixon, Daysdale, Jerilderie.

" " J. Jones, Senr., Berrigan.

Mr. William Anderson, Pine Hill, Altcar, Moama.—Recommended for First Prize.

I visited this farm on the 12th November, 1892, and was much struck with its particularly neat and clean appearance. The paddocks are well arranged, the crops luxuriant and entirely free from weeds, and the fences and gates are substantial and in excellent order. The horses, sheep, and cattle are of good quality and in good condition, and the homestead buildings are substantial, and indicate prosperity and comfort. Mr. Anderson works his farm with the assistance of his three sons, additional help being obtained in busy seasons.

The property covers an area of 3,500 acres, of which 400 acres are under wheat for grain, 20 acres for hay, and ½ an acre under a good crop of potatoes. There are also 200 acres of fallow land, 100 of which are devoted

to the cultivation of rape for sheep feed. This is the system of rotation followed, and the feeding off of the portion devoted to rape keeps that portion not only quite free from weeds, but highly manured, securing continued fertility. Mr. Anderson informed me that after seven or eight years experience of his system he has never known rust to occur in wheat crops sown after rape. It may be of advantage to mention that the practice is to sow the rape in September, and to feed it off lightly in a few weeks. The sheep are then taken off, and the rape allowed to grow until after harvest, so that when the dry weather comes there is a crop ready for fattening purposes. The system is one which may safely be commended to farmers in the western district, as not only does it pay well, but is a handy means of securing rotation of crops.

The subsidiary aids to the farm comprise butter, cheese, poultry, fruit, preserves, and during February and March, when the grass is very dry, fat sheep and lambs. With the exception of the stock, which are usually disposed of in Melbourne, most of the subsidiary products are sold locally or "down river" as it is termed, but I was unable to obtain particulars as to the prices realised.

As regards conservation of water and its economic application, there are two underground and several iron tanks to catch water from the roofs of the house and other buildings, which provide a never-failing supply for homestead purposes. A pump for the underground tanks is the only appliance. For stock purposes open tanks have been constructed in every paddock, and although the means of economic application are not in evidence in the shape of appliances, I felt bound to award a high percentage of points in consequence of the very careful and satisfactory method of distribution.

The means used for conserving fodder consist of a good hay-shed and chaff-house, together with outside stacks strongly thatched.

The implements comprise a double and a treble furrow plough, scarifiers, and all others necessary to work the land. For harvest purposes there are two combined harvesters, worked by four horses and a man, each team being capable of cutting and bagging 50 bags per day. There is also a reaper and binder, and a winnowing machine. The whole of the implements are in fair working order.

As regards productiveness of crops the wheat growing at the time of my visit was estimated to realise from 25 to 30 bushels per acre, and the hay 2 tons per acre. The grass paddocks, being cleared of all fallen timber, show highly satisfactory crops of nutritious herbage.

No underground draining has been attempted, and in my opinion none is necessary. As I have pointed out in my general report, the nature of the soil in this district renders such an expense quite unnecessary so far as my visits enabled me to form an opinion.

The system of manuring is to feed off the rape crops, by means of folding sheep, thus securing their droppings to enrich the land. For garden and orchard purposes, the ordinary farm-yard manure is collected in convenient heaps, and turned over so as to be ready to apply as required. I would suggest more care on the part of farmers in this district in regard to covering their manure to prevent waste.

The stock is good, both as regards class and condition. There are twelve draught horses used for working the farm. The cattle consist of twelve cows and their increase of the Durham breed, and there are also 4,900 Lincoln sheep and lambs. Mr. Anderson breeds his own stud rams.

The fences are post and wire, made sheep-proof, and together with the gates, are kept in very good repair.

The farm-house is constructed of wood, with an iron roof, and contains six rooms. It is well built, and is kept in excellent order. The kitchen, which is separate, is a substantial building, and, as in the case of nearly all other buildings, is constructed of wood and iron. The dairy, with which is combined a cellar and store-room, is built of brick, and is fitted with an iron funnel going out through the roof, surmounted by a revolving appliance, so fitted as to turn the opening windwards. This has the effect of securing a continual draught of fresh air into the building, which is thereby kept very cool and wholesome.

The mode of book-keeping is to jot down each item of income and expenditure, and to balance the account each year end. According to this statement the income for the year 1891 is shown as £2,004 12s. 1d., and the expenditure at £1,493 11s. 8d. As, however, no record is kept of the amount expended on improvements, it is difficult to arrive at the nett profits for the year.

The garden appears well attended to, and more than supplies home requirements. It contains also a number of fruit-trees, kept in good order, and entirely free from weeds, and the whole is surrounded by a paling fence.

Mr. Chas. M'Alister, Murray Hut, Jerilderie.—Recommended for Second Prize.

My visit of inspection to the farm of Mr. M'Alister was paid on the 17th November, 1892, and occupied also a portion of the following day. The property comprises 4,600 acres of freehold land. The portion cultivated consists of eight paddocks, 150 acres each, the balance being used for grazing purposes, carrying no less than 5,560 sheep.

The crops at the time of my visit consisted of 200 acres of wheat, 70 acres of wheat for hay, and 300 acres of lucerne for sheep feed. There are also 270 acres fallowed for next year's wheat crop.

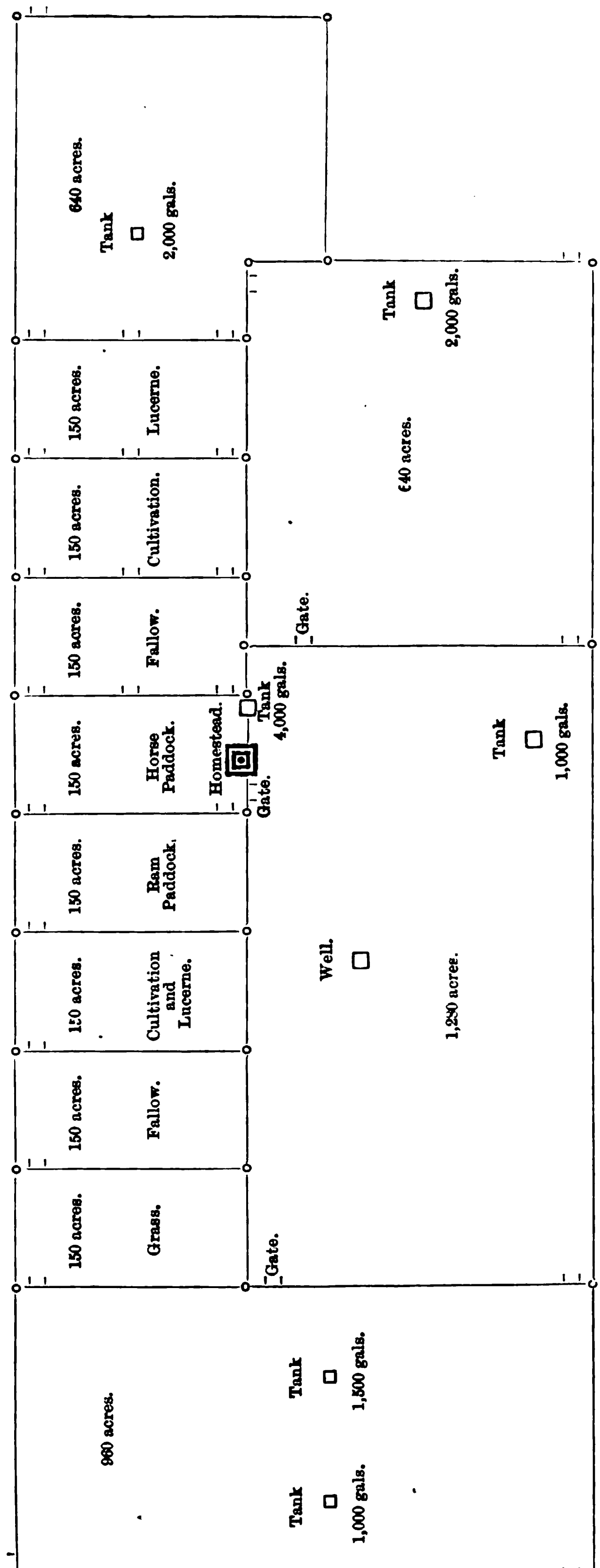
Management with a view to profit is evidently Mr. M'Alister's object in working his farm. Every portion of it is kept in good order, and everything is in its place. The improvements are well designed, and substantial in character, and all the crops are clean, with the exception of a small patch of self-sown hay.

The system of rotation is the same as that usually followed in the Western Plains District, being wheat, hay, and fallow. The fallow is grazed by sheep, after being well ploughed in winter. The lucerne crop, which is a comparatively new departure, will be dealt with more fully under a subsequent heading.

The subsidiary aids to the farm consist principally of sheep and wool, the former producing about £300, and the latter about £800 yearly. There are also produced butter, honey, poultry, bacon, and fruit, but as I am under the impression that the sales of these products are comparatively unimportant, I obtained no details.

Water for stock is ensured by means of six tanks of various and ample capacities, and conveniently placed, as will be seen by a reference to the accompanying plan, which Mr. M'Alister was kind enough to hand to me. These secure an almost inexhaustible supply, but in very dry seasons water is raised by means of a horse whim, and conducted to the different dams to prevent the possibility of want of water by the stock. For homestead purposes there is an underground tank of ample capacity, to which a pump is fitted for raising water for use.

SKETCH OF MR. C. McALISTER'S FARM, MURRAY HUT.



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The means used for conserving fodder are principally stacks, covered by a substantial thatch. There is also a well-built chaff store, with a boarded floor.

The implements used on the farm consist of one reaper and binder, a stripper, a winnowing machine, two three-furrow ploughs, a wool press, and all other tools necessary for working the farm, including a kit of tools for blacksmith's work. Everything is in fair working condition.

The productiveness of the crops is very fair on this farm, the standing crops which I saw being estimated to produce 20 bushels of wheat and about 30 cwt. of hay per acre.

The system of manuring consists chiefly in grazing sheep on the fallow land, but all the farm-yard manure is carefully gathered up and applied as required to the garden and orchard.

The stock on the farm are of good quality, and in excellent condition.

The fences are post and wire, made sheep-proof, and the gates are well placed, all being of substantial construction, and in good order and condition.

Both the plan and character of the house and buildings are good, the roofs in all cases being of iron. The farm-house, which contains seven rooms, is built of timber, and well finished. There is also a store-room, with cellar and dairy underneath, a good kitchen, an iron roofed woolshed, to which are attached substantial and convenient drafting yards.

No system of laying down grasses has, so far, been adopted. The useful fodder plant, lucerne, has recently been sown pretty extensively by way of experiment, and although no figures were obtainable as to the actual improvements effected by this departure, the number of sheep mentioned above shows an extraordinary high carrying capacity, which no doubt is to a great extent due to the lucerne. Although Mr. M'Alister is to be commended for this new departure, I cannot, after careful comparison, help giving my opinion in favour of rape, as utilised by Mr. Anderson.

The system of book-keeping is good as far as it goes, each day's receipts and expenditure being carefully booked, with the result that the former amounts to about £2,000, as against about £1,000 for the latter for the year.

Unfortunately, no actual nett profit can be shown, in consequence of the omission to record the expenditure on improvements.

The garden, which includes fruit-trees and grape-vines, is well looked after, and snugly fenced, the whole looking a picture of neatness.

Messrs. N. A. Gatenby & Co., Jemalong, Forbes.—Recommended for Third Prize.

I inspected the holding of Messrs. N. A. Gatenby & Co. on the 5th December, 1892. The property comprises 47,000 acres, only 400 acres of which are set apart for cultivation purposes. The area actually under crop at the time of my visit, consisted of 40 acres of wheat for grain and 30 acres for hay, 40 acres of maize, 140 acres lucerne, 22 acres of peas, 11 acres English grasses, $2\frac{1}{2}$ acres of sorghum, 5 acres of rye, 20 acres of oats, and $\frac{1}{2}$ an acre of potatoes, and some mangels.

The general management, with a view to profit, may be classed as fairly good. The crops are not quite as clean as they might be. The maize, for instance, had been left too long without cleaning, and, as a consequence, it was stunted. Moreover, when weeds are allowed to gain too firm a hold, the labour of cultivation is doubled. The mangel crop also would have been better for a little attention in the shape of hand hoeing.

The system of rotation is fair, being to crop the land for a few years, and then sow lucerne for feeding the stock used for breeding stud sheep.

The subsidiary aids to the farm are bacon, and preserves for home use. Wool was mentioned to me under this heading, but in view of the return for the year of this product (£5,000), and to the fact that the property is more nearly a squattage than a farm, this could hardly be quoted in such a connection.

Conservation of water and its economic application, are strong points on this property, and Messrs. Gatenby have already secured a National Prize. I may perhaps mention that the water is pumped from the Lachlan River by means of a 30 horse-power engine and pump, and carried through open drains not only to the homestead and all over the cultivation area, but in exceptionally dry seasons arrangements are easily available for replenishing the stock-tanks, 5 miles back on the run. As far as I could ascertain, the machinery is sufficient to do more than is at present required of it, and even now the crop of lucerne shows distinct signs of the beneficial effect of a copious supply of water. The system of drain-cutting is worth more than a passing description. The land in the direction a drain is required is ploughed to the width desired by means of a bullock team. The bullocks are then hitched to a delver which is passed along the ploughed track to shift the loose earth. This delver is constructed something like a plough at the point or share portion, and a board shod with iron is fitted on so as to act as a scraper, which brushes the loose soil to the sides of the drain. This board is made in sections which are movable, and as depth is required the board is altered accordingly. The cost of the drains constructed on this system is 1s. per chain.

Conservation of fodder is another matter which receives considerable attention. There is a well-built grain shed, and all the stacks are carefully thatched with rye straw. The hay is drawn to the stacks by means of horse-rakes, a method which I find causes it to taste and smell very dusty.

The implements used include a portable engine for chaff-cutting, stump-jumping ploughs, stripper and cleaning machine, mowing machine, and all other necessary tools for working the farm.

The productiveness of the crops may be regarded as fair.

There is no system of manuring, only a portion of that made on the farm being collected and applied to the potato and some other vegetable crops.

The fences and gates are not in very satisfactory condition, and would be all the better for a few necessary repairs.

The stock consists of 47,000 sheep, 800 cattle, and several horses, the class and condition of which may be stated as good.

The farm-house is a well-finished wooden building containing nine rooms. There is also a kitchen and two rooms, bath-room and store-room, under a separate roof, all the roofs being of iron. There are also some fairly good out-buildings.

Some English grasses have been laid down with fairly good results.

The mode of book-keeping appears to be perfect, all the different accounts being kept separately and clearly, but beyond the return of £5,000 for wool, and £700 for hay and maize, I did not obtain any figures, as most of the produce is consumed on the estate.

The new points of interest about the farm are the irrigation works and a pit of silage containing about 50 tons.

The garden, which is well fenced, supplies the homestead with fruit and vegetables.

Mr. Samuel Nixon, Daysdale.—Highly commended.

I inspected the farm of Mr. Nixon on the 22nd November, 1892, the situation of which is 12 miles from Daysdale, in the Corowa district. The property comprises an area of 860 acres of freehold land, the quantity under cultivation being 330 acres of wheat, 30 acres of oaten hay, a small paddock of lucerne, 1 acre of potatoes—a good crop, and 110 acres lying fallow.

This property is very well managed, and great improvements have been effected. The crops are as clean as it is possible to keep them, although the greater part of the work is performed by Mr. Nixon alone.

The system of rotation is similar to that followed on the majority of farms in the district, viz., one-third fallow after two crops of wheat and hay.

The subsidiary aids to farm consist of fat sheep, wool, butter, bacon, poultry, and fruit. The wool harvest comes in first, and the cash realised pays for gathering in the wheat crop.

Conservation of water is effected by means of a well and open tanks, or dams; while for the use of the homestead there are several iron tanks and an underground tank fitted with a pump, this being the only appliance.

The means used for conserving fodder consist of a good chaff-house and outside stacks, which are all well thatched.

The implements used comprise two and three furrow ploughs, reaper and binder, strippers, and a number of smaller tools necessary to work the farm, all of which are in fair working condition.

The production of the crops is very fair.

The system of manuring followed is to collect all the farm-yard manure into a heap, and apply it as required for the growth of vegetables.

The stock consists of 14 milch cows of the shorthorn breed, 12 draught horses to work the farm, 900 sheep, and some good improved Berkshire pigs. The whole are of a good class and in good condition.

With regard to the character and condition of the fences and gates, the former are constructed of posts and wire. The gates are in fair order, but are not very strong, being made of light saplings.

The house and out-buildings are only of fair construction, the former containing four rooms. Having only been in possession four years Mr. Nixon will probably improve upon these later on.

There is no system of laying down grasses, but a small paddock of lucerne is grown as a stand-by.

The garden is well stocked with fruit and vegetables, and well fenced. There are also six acres of young vines looking healthy and very clean.

There is very little attempt at book-keeping, but a statement handed to me of receipts and expenditure, taken from Mr. Nixon's banker's pass-book, shows receipts for the year 1891 at £1,466 12s., and payments £133 17s., leaving a balance of £1,332 15s. As, however, nothing is charged for Mr. Nixon's own labour, and other items necessary for an accurate statement of profit and loss, these figures must be taken for what they are worth. There is no doubt that the farm is a paying concern.

Mr. John Jones, Berrigan.—Highly commended.

I visited this farm on the 21st November, 1892, for the purposes of inspection. The property consists of 1,280 acres of freehold land. Of this there are in cultivation 360 acres of wheat, 50 acres of this being for hay, 24 acres of oats, 16 acres of barley, 22 acres of rape, and 22 acres of lucerne for sheep feed, and 200 acres of fallow land. There are also 7 acres of grape-vines and 4 acres of vegetables and fruit.

The crops are above the average as regards cleanliness and cultivation, the results of which are clearly shown by their healthy and forward condition.

The system of rotation is wheat followed by oats, and then fallow with rape and lucerne for sheep feed and to clean the land, and, considering that Mr. Jones has only been in possession about four years, I have no doubt that this farm will take a much more prominent position in future competitions.

The subsidiary aids to the farm consist of fat sheep, wool, poultry, bacon, butter, and fruit, but I did not obtain any particulars regarding markets or prices realised.

Conservation of water is effected by means of a dam, with iron tanks for homestead use. There are no appliances.

The means used for conserving fodder are simple stacks; but the short time of occupation will probably account for this, as well as for want of appliances in the previous item.

The implements used are of fair kinds, and in fair working condition.

The production of the crops per acre is estimated at 20 bushels wheat, 35 cwt. hay, 60 bushels oats, and 35 bushels barley.

The system of manuring is to collect all the farmyard manure in a heap and place it as required on the garden and orchard.

The character and condition of fences is very good, they being constructed of posts and wire, and made sheep-proof. The gates are strong, serviceable, and in good repair.

The farm-house is well built of timber, with an iron roof, and contains seven rooms. The kitchen is also wood and iron, and the outbuildings are of wood with straw thatch roofs. The store room and cellar are well ventilated by means of pipes running some distance out underground and then branching upwards, the end being fitted with a movable top piece, so fitted as to bring the opening always facing the wind, and thus ensuring a direct current of air into the building.

There is no system of laying down grasses followed, but the fodder plants, lucerne and rape, are sown for sheep-feed.

The mode of book-keeping is to enter up each day's transactions; but as these, though entered were not balanced, I am unable to give the results.

The only new point of interest is a small stack containing about 10 tons of silage. This consists of sheafed hay, and is weighted with timber.

The vegetable and fruit garden is kept very clear of weeds, and no less than 7 acres of raisin grapes have recently been planted.

Mr. Samuel Wilson, Currah Farm, Jerilderie.

I inspected Mr. S. Wilson's property on the 11th November, 1892. The farm is situated 6 miles from Jerilderie, and comprises 2,405 acres of freehold and 791 acres of leased land. The portion under cultivation consists of 145 of wheat for hay, 30 acres of lucerne for sheep-feed and 110 acres fallow. There are also 14½ acres under orchard and vineyard from which Mr. Wilson sold £200 worth of fruit last year.

The general arrangement with a view to profit is very fair.

The state of the crops as to cleanliness and cultivation is not so good as it might be. Mr. Wilson grows all hay, and the wild or black oats have a very firm hold on the land.

The system of rotation is to grow wheat for hay, and then leave a portion fallow, which is ploughed and worked in the summer time, and grazed with sheep.

The subsidiary aids to the farm are wool, bacon, butter, poultry, and fruit.

Under the head of conservation of water and its economic application may be mentioned six open tanks or dams, one underground tank, and two wells, while the only appliance is a pump fitted to the underground tank.

Fodder is conserved by means of a hay-shed, a chaff-house, and well thatched stacks.

The implements consist of three single-furrow, two double-furrow, and one stump-jumping ploughs, and all other necessary implements for working the land, also two reapers and binders, one mowing machine, one chaff-cutter and bagger, and one 7-h.p. engine.

The productiveness of crops is fair.

The system of manuring consists in collecting all the farmyard manure into a heap where it is allowed to rot, and is put on the garden and orchard as required. Some green peas have also been ploughed in to renovate a a portion of the land.

The stock consists of 12 draught horses, 13 dairy cattle, and 2,000 sheep. The quality is not high as regards breed, but all are in good condition.

The fences are constructed of posts and wire—sheep-proof, and all the gates are in fair condition.

The farm-house is built of brick, and contains seven rooms and cellar. There are also a dairy, kitchen, and store-room; all good buildings covered with iron.

There is no system of laying down grasses, but lucerne is sown for sheep-feed.

The vegetable and fruit garden covers 7½ acres, the whole of which is kept in excellent order. There are also 3 acres of grape-vines, 1 acre is planted with orange trees, and 3 acres with fruit trees, which look very healthy, and show evidence of great care and attention.

A careful record is kept of income and expenditure, the income showing a large profit on the outlay.

Messrs. Drummond Bros., Berrigan.

I inspected Messrs. Drummond Bros.' property on the 21st November, 1892. The area of the farm is 680 acres; of which 400 acres, are under wheat; 30 acres for hay, 8 acres fallow, 4 acres of orchard and garden, and 18 acres under vines, not yet in bearing. The wheat land is only partly cleared, and is not as clean as it should be.

The system of rotation is fallow after wheat and hay.

The subsidiary aids to the farm are butter, milk, poultry, and bacon.

Water is conserved by means of wells of permanent water raised by ropes and pulleys worked by horse-power. There are also iron-tanks for supplying the homestead. The only appliances are the ropes and pulleys already mentioned.

The only means used for conserving fodder are stacking and thatching.

The implements consist of six-furrow, four-furrow, and single-furrow ploughs, reaper and binder, and stripper; also, a number of tools necessary for working the farm.

All the farmyard manure is gathered up and applied to the garden.

The stock are of a good class and in good condition.

The fences are all posts and wire—sheep-proof, and the gates are strong and kept in good repair.

The farm-house is built of timber, is well finished, and contains five rooms. There are also a large kitchen and a bath-room with iron roofing. The out-buildings are wood with straw and thatch roofs, and include a blacksmith's shop with a good supply of tools.

All transactions are entered daily, but no balance having been struck at the time of my visit, I am unable to give any idea of profits.

The only new point of interest is a small pit of silage containing about 10 tons.

The vegetable and fruit gardens are kept in excellent order.

Mr. H. J. H. Keeping, Boogaldi, Coonabarabran.*

I inspected the property of Mr. H. J. H. Keeping on the 10th and 12th December, 1892. The farm consists of 390 acres of freehold land, and out of this there are under cultivation 35 acres of wheat, 6 acres of hay, 14 acres of maize, 1½ acre of potatoes, 4 acres orchard, 3½ acres vineyard, and 1 acre of a vegetable garden.

The general management is fair. This is only a new place, and many of the improvements are as yet incomplete.

The crops are fairly clean with the exception of the maize, which requires some attention. Some of the cultivation area is not cleared of timber.

The system of rotation is good.

The subsidiary aids to the farm are vegetables, bacon, wine, and butter, with preserves and jam for home use.

Water is conserved by means of tanks for the use of the homestead, and there is also a creek running through the property which affords a plentiful supply. There are no appliances.

The means of conserving fodder consist of a good hay-shed with iron roof.

The implements consist of a double-furrow plough, reaper and binder, stripper, and cleaning machine, together with other necessary tools to work the farm, all of which are in good order.

The production of crops is very fair.

The system of manuring is to camp travelling sheep in the land, and as large numbers travel that way the method is very effective. The manure made on the farm is also collected and applied as required.

The class of stock is fair, but their condition leaves something to be desired.

The fences are fair, the greater part of them being of palings. The gates are good and kept in good repair.

The farm-house is a new building of timber and iron roof. All the outbuildings are roofed with iron, and are in good condition.

The fruit-trees look healthy and are well attended to, and the garden is well stocked with vegetables.

The system of book-keeping is inadequate, and the entries are not kept up to date.

Mr. Thomas Treloar, Studley Park, Deniliquin.

I inspected the holding of Mr. Treloar on the 15th November, 1892. This farm is situated 10 miles out of Deniliquin, and contains 1,280 acres of rented land. The fact of Mr. Treloar being only a tenant places him at some disadvantage in regard to improvements, as he is a most industrious and persevering man, and, from what I saw, I feel sure that were he owner there would be many useful improvements effected which it would hardly be reasonable to expect him to do under existing circumstances.

* NOTE.—This farm was fully described in connection with the previous year's competition.

The general management, with a view to profit, is good, and must give satisfactory returns.

The state of crops is only fair as they are not quite free from weeds such as wild oats, drake or rye grass, and barley.

The system of rotation is wheat, hay, and peas, with a proportion of fallow land.

The subsidiary aids to the farm consist of butter, poultry, eggs from choice fowls, wool, and fat sheep for sale, also preserves, pickles, and fruit for home use.

The means for conserving water consist of open and covered dams or tanks, and iron tanks for homestead use; there are no appliances.

The means used for conserving fodder are stacks, well thatched, and a good chaff-house.

The implements consist of single, double, and three furrow ploughs, scarifiers, harrows, and all necessary tools for working up the land; reaper and binder, stripper, and winnowing machine, all in good working order.

The productiveness of the crops is fair.

The system of manuring is to collect all farm-yard manure and place it in a catch-hole below the stock-yard, and apply it as required to the vegetable garden. Some artificial manures have been used with good results, but only for vegetables.

The stock are good both as to class and condition.

All the fences are constructed of posts and wire—sheep proof, and there are both gates and slip-rails, the condition of the whole being fair.

The farm-house is built of brick with an iron roof, the inside walls being plastered. It contains six rooms, and is a good substantial building. There is also a good kitchen with an iron roof, but the out-buildings, though strong, are somewhat rough in appearance, owing to their thatched roofs.

The garden contains a good variety of vegetables and a few fruit trees, the whole being very clean and showing careful attention. A portion of the garden is planted with seventeen different varieties of wheat, looking very healthy and free from rust.

Mr. C. Gaymard, Forbes.

I inspected the property of Mr. Gaymard on the 2nd December, 1892. This farm consists of 140 acres of land, the portion cultivated comprising 55 acres of wheat, 20 acres of hay, 2 acres of pumpkins and maize, 12 acres of vines, and 11 acres of fruit-trees and vegetables, the former preponderating.

The general management with a view to profit is very fair. The vines and fruit-trees are kept very clean, and are well attended to, but the crops do not appear to receive so much attention.

The place having been but slightly cropped as yet, no system of rotation has been adopted.

The subsidiary aids to the farm are fruit, wine, bacon, and poultry.

Water is conserved by means of tanks for stock, while for homestead use there is a well and an underground tank. The only appliance is a pump worked by horse-gear for watering the garden.

For the conservation of fodder there is a hay-shed covered with iron, while all the stacks are thatched.

The implements used comprise single and three furrow ploughs, mowing-machine, and stripper, winnowing-machine, together with tools necessary to work farm, orchard, and vineyard. The whole are in fair condition.

The production of the crops is fair.

Manure is not much needed, but what is made by the pigs and that gathered about the place is applied to the fruit-trees as mulching.

Only a few horses, some milch cows, and pigs are kept, but they are of fair quality, and in good condition.

The farm-house is a well-constructed wooden building, roofed with iron, containing seven rooms. There is a detached kitchen and out-buildings, all well constructed and roofed with iron, including wine-cellar, store-room, &c.

The character of the gates and fences is very fair, the latter being of posts and wire.

The accounts are kept in the French language, but, upon explanation, I allowed the points given under this head, as it was shown to be a paying concern.

The orchard and vegetable garden is certainly the best managed part of the property, and I consider it would have been better to have entered it in the section for orchards.

Mr. James Casey, Piney Range.

I inspected the property of Mr. Casey, the nearest town to which is Grenfell, on the 1st December, 1892. This farm consists of 9,545 acres of freehold land, the portion under cultivation comprising 54 acres of wheat, 22 acres of hay, 12 acres of maize, 3 acres of peas, 3 acres of potatoes, and half an acre of table grapes.

The general management is only fair, and the crops are not so clean as they should be, the maize crop particularly being choked with weeds. The land is only partly cleared of timber, and there are some stumps in the hay crop. This probably accounts for the hay being cut with a scythe, and gathered by means of hand-rakes and forks in the old-fashioned way.

The rotation adopted is wheat, hay, and maize.

The subsidiary aids to the farm are bacon, poultry, butter, wool, and sheep, together with jam and preserves for home use.

Water is conserved by means of eleven open tanks for stock, measuring from 1,000 to 3,000 yards, and there is an underground tank for homestead use, but no appliances.

Fodder is conserved under a good hay-shed roofed with iron.

The implements consist of two double and one single furrow ploughs, one stripper and winnowing machine, harrows, scarifiers, and other smaller tools.

The productiveness of the crops is only fair.

The system of manuring is to graze sheep on the land, while the other manure collected on the farm is applied to fruit-trees and vegetables.

The class and condition of the stock is very fair.

The fences are constructed of posts and wire, quite sheep-proof. The whole of the property is fenced, but the dividing fences are not so good as the outside fence. The gates are not very good.

The farm-house is built of timber, with an iron roof, is fairly well finished, and contains seven rooms. The kitchen is well built and roofed with iron, and the underground dairy and out-buildings are fair.

The mode of book-keeping is fairly good, and the accounts appear properly kept, and show the yearly income from the farm and 6,700 sheep to be £2,000.

The cultivated portion of the farm is on the east side of the property, about 4 miles away from the homestead.

MIXED FARMS—WESTERN PLAINS DISTRICT.

TABLE showing the points obtained by the various competitors.

	Wm. Anderson, Moama.		Chas. McAlister, Murray Hut.		N. A. Gatenby & Co., Jemalong, Forbes.		Samuel Nixon, Daysdale.		John Jones, Berrigan.		Samuel Wilson, Currah Farm, Jerilderie.		Drummond Bros., Berrigan.		H. J. H. Keeping, Boogaldi, Coonabarabran.		Thos. Treloar, Studley Park, Deniliquin		C. Gaymard, Forbes.		James Casey, Pinoy Range, Young.	
	Maximum points.	Points awarded.	Maximum points.	Points awarded.	Maximum points.	Points awarded.	Maximum points.	Points awarded.	Maximum points.	Points awarded.	Maximum points.	Points awarded.	Maximum points.	Points awarded.	Maximum points.	Points awarded.	Maximum points.	Points awarded.	Maximum points.	Points awarded.	Maximum points.	Points awarded.
General management with a view to profit	125	125	125	120	125	105	125	125	125	125	125	110	125	120	125	100	125	120	125	110	125	100
State of crops to cleanness and cultivation	100	100	100	80	100	85	100	100	100	100	100	80	100	80	100	90	100	75	100	85	100	80
System of cultivation, rotation, &c.	80	80	80	60	80	60	80	70	80	60	80	50	80	60	80	60	80	60	80	60	80	40
Number and condition of subsidiary aids to farm ..	80	60	80	70	80	60	80	60	80	50	80	70	80	40	80	60	80	50	80	60	80	70
Conservation of water and its economic application..	80	60	80	80	80	80	80	60	80	60	80	70	80	65	80	50	80	50	80	50	80	50
Means used for conserving fodder	60	50	60	40	60	40	60	40	60	40	60	50	60	50	60	55	60	40	60	50	60	50
Kinds of implements used, condition, &c.	60	60	60	50	60	50	60	50	60	50	60	50	60	50	60	50	60	50	60	50	60	40
Productiveness of crops	50	45	50	40	50	45	50	45	50	45	50	40	50	45	50	45	50	40	50	40	50	45
System of underground drainage	50	*	50	..	50	..	50	..	50	..	50	..	50	..	50	..	50	..	50	..	50	..
System of manuring	50	45	50	20	50	20	50	30	50	20	50	30	50	30	50	30	50	40	50	20	50	20
Conservation of manure made on the farm	50	30	50	20	50	20	50	20	50	20	50	20	50	..	50	20	50	40	50	20	50	20
Class and condition of stock	50	50	50	50	50	50	50	50	50	50	50	40	50	50	50	45	50	50	50	40	50	45
Character and condition of fences and gates.. ..	40	40	40	40	40	35	40	38	40	40	40	35	40	40	40	35	40	35	40	30	40	35
Plan, character, and condition of farm-house, buildings, &c.	40	35	40	40	40	35	40	30	40	30	40	40	40	35	40	40	40	25	40	35	40	35
System of laying down grasses	20	..	20	15	20	20	20	5	20	10	20	10	20	..	20	..	20	..	20	..	20	..
Mode of book-keeping	20	20	20	20	20	20	20	10	20	18	20	20	20	18	20	10	20	..	20	15	20	20
Any new point of interest, and commercial value, such as new crops, ensilage, &c.	20	..	20	..	20	15	20	..	20	10	20	..	20	10	20	..	20	..	20	..	20	..
Vegetable and fruit-garden	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Total	1,000	825	1,000	770	1,000	765	1,000	758	1,000	753	1,000	740	1,000	718	1,000	715	1,000	700	1,000	690	1,000	675
Percentage of excellence	..	% 82·7	..	% 77	..	% 76·5	..	% 75·8	..	% 75·3	..	% 74	..	% 71·8	..	% 71·5	..	% 70	..	% 69	..	% 67·5

*Not required.

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Citrus Orchards.*

JAMES HAROLD, Judge.

As Judge of Citrus Orchards for the year 1892, I have the honor to report that I commenced my duties 23rd November, 1892, and ended them 25th January, 1893, having been engaged in the actual work of inspection seven days. The competing orchards in my section were situated in the county of Cumberland, save one. There were eight competitors in all, six in the class for small orchards of under 10 acres each, and two in the class for orchards of over 10 acres. Taken as a whole the competing orchards were hardly representative of the great Citrus industry of New South Wales. Many of the most flourishing and largest orchards of the country were not entered, while five of the eight competing orchards were young, only ranging from 4 to 9 years of age, and, of course, had not therefore come into full bearing. As to results and conditions they consequently could not be compared with older and full bearing orchards. As representative orchards of their area, conditions and age, they were however very good specimens and yielded handsome results. Of the three old orchards entered, one was eight acres in extent, and was 23 years of age; one was 5½ acres in extent, and was 21 years of age, and the other was over 20 acres in area, and the trees in it ranged from 22 to 45 years of age. I found an inspection of these orchards very instructive and very illustrative of the capabilities of the country for the production of Citrus fruits, of the longevity of the trees under the conditions afforded, and of the results of the growing of this class of fruit. As to results, I spared no pains to arrive at a just estimate of the expenditure necessary for the production of the fruit and the income derived from its sale. The statements of expenditure and income which will be found appended to my detailed statement of each orchard, I obtained under the hands of the proprietors, and they are in every case the owner's own statement just as he chose to make it.

In these statements there may be discrepancies, some of the figures given are for 1891, and others for 1892, and as the price of fruit varied considerably during these years, one orchard may in consequence be made to appear to produce much more than another. Yet, notwithstanding these discrepancies the figures as a whole are most valuable as illustrating the average productiveness under good conditions, of this valuable industry.

I do not say that the statements herein given of the profits derived from the year's operations of the orchards in the competition are to be taken as the average results of the Citrus fruit-growing industry throughout New South Wales. To make up the average for the whole country every orchard, good, bad, and indifferent would have to be enumerated, and I am painfully aware that many orchards would have to be accounted for in that average that yield the proprietors no returns at all. To strike an average for the whole country from the profits derived from the cultivation of the eight orchards inspected by me would be manifestly unfair and would be too high. But it would be just as unfair to strike an average by the incorporation of all dead and decaying orchards in the statistical statement of the year's operations for this branch of industry.

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* Note.—The statements of account given in this report were obtained by me on the understanding that they were for publication.—J. H. (Judge).

Apropos of dead and decaying Citrus orchards, I might be permitted to say in passing that in the county of Cumberland there are too many of them at the present time; and, as many of them are beyond all hope of rejuvenescence, measures should be at once taken to uproot and destroy them. As they now stand they are useless to the owners, an eyesore to the community at large, a harbour of insects and diseases generally, a source of danger to the fruit-growing industry, and a standing stigma on the efficiency of our agricultural system. They yield no adequate return for the labour bestowed on them, and many of them are a dead loss to the owners. They help to depreciate the value of property immensely in the districts in which they are situated, for what stranger in search of an investment for his money would care about buying an orchard if he had to pass half a dozen dead and dying ones on the road to inspect it. As well might a merchant try to sell goods at remunerative rates if his counters were littered with rotten and damaged pieces of the same material he wished to sell. Land-owners should insist on the destruction of these worthless orchards in their respective districts, for they have a depreciating influence on everything near them. They help to lower the average of the earnings of the orchards generally, and thereby materially depreciate the value of really good orchards. The lands of the county of Cumberland are certainly not the best for growing citrus fruits, but by reason of marketing facilities the bulk of the orchards have been planted there. The orange-tree thrives best in a deep calcareous, well drained, well sheltered loam, and in many situations in which decaying or dead orchards are to be found these conditions are entirely wanting. In too many cases these orchards are planted in a poor thin loam, with a cold yellow clay subsoil, with no shelter, either natural or artificial, deficient drainage, deficient tillage, no manure, and no repression of insects. Still, the owners of some of them wonder why they decay. The only wonder is that the plants ever lived at all under the conditions. Their lives must, however, be of short duration.

In the orchards which I visited I found considerable diversity of opinion among the owners as to the best methods of cultivation, manuring, draining, pruning, &c. In some of them nearly all the labour is done by horse power and modern improved implements, while in others the cultivation is wholly done by hand labour with the spade, hoe, and fork. The hand labour certainly costs the most, but I saw no difference in the vigour and health of the trees, all things being equal, in the hand labour over the cheaper horse power. Several of the competing Citrus orchards formed a portion of a mixed orchard of deciduous, pomaceous, and citrus fruits, and sometimes grape vines. While I have not the slightest inclination to dictate either to the Department of Agriculture or to the owners as to the principle upon which competitions shall be carried out, yet it is a question in my mind whether the most satisfactory results would not be obtained by a man entering all his property for competition. If he grows Citrus fruits only, let him compete in that section, but if he is the cultivator of a mixed orchard and a farm perhaps besides, let him compete in a section for those properties. Where a portion of an orchard or a property only is entered for competition it may happen that that portion is well cultivated for the year of competition at all events, while the other portion is more or less neglected. In fact, I have seen cases in point. Again, in cases where a portion only is under competition, it is difficult to adjudge the proportionate amount of labour due to each, and sometimes considerable produce from other parts comes in as subsidiary aids and helps to swell the total receipts, which is unfair to the man who depends wholly on one class of fruit, and has no such aids to swell his accounts.

I found a very general opinion among the competitors that citrus orchards should be judged (say) in September, when the fruit can be seen to the best advantage upon the trees, and I promised to make this matter the subject of a special note to the Department.

Orchards under 10 acres.

Mr. G. H. Dempsey, Orchardleigh, Emu Plains; 8 acres orchard.—Recommended for first prize.

Mr. G. H. Dempsey's orchard is situated about 1 mile from the Emu Plains railway station. The orchard contains a total area of 10 acres, but only about 8 acres of that extent is planted to Citrus trees. The land slopes gently towards the Nepean River, and is composed of a deep friable loam of several feet deep and a subsoil of boulder drift. A better situation or a more suitable soil for an orange grove could not be found in the district. The orange-trees are now 23 years of age, and they are still exceedingly healthy and free from any serious disease. The land shows a good state of cultivation, and where necessary it has been drained, although it is so favourably situated for natural drainage that artificial drainage would be thought to be unnecessary. Mr. Dempsey has, however, experienced the greatest benefit from his drains, a fact that might be noted with advantage by other fruit-growers similarly situated.

This orchard is one of the few irrigated properties in the coastal districts. For furnishing it with water, a well 28 feet deep and 7 feet in diameter has been sunk. In the well there is 15 feet of water, which percolates from the Nepean River, and is well nigh inexhaustible. The well is 12 feet deep through soil to the gravel. To raise the water to the necessary level to water the orchard by gravitation a 3-h.p. Tangye engine and pump, which will raise 1,200 gallons of water per hour to a height of 30 feet, is used. The water is pumped into two 400-gallon tanks, which act as pressure tanks, from which it is allowed to flow by gravitation where desired.

The orchard is free from pests, with the exception of the orange mite, but a spraying of soft soap, sulphur, and water keeps these pests in check. The property is well-fenced, and there are the necessary modern implements for working it. The trees are now, however, grown so large that much of the labour must be done by hand. There is a good dwelling-house and the necessary out-buildings for packing, storage, &c. The result of the year's operations for the year 1891 was £470 9s. 6d.

	£	s.	d.
F. Arendt, Bourke	56	18	0
Nancarrow and Bartlett, auctioneers, Bourke	16	19	3
J. W. Critchley, fruiterer, Nyngan	29	12	6
W. H. Clarke, fruiterer, Bourke	3	4	0
J. Cunninghame, fruiterer, Dubbo	20	6	0
W. Doherty & Co., auctioneers, Bourke	9	6	6
W. Cumming, fruiterer, Dubbo	6	7	6
G. Edwards, fruiterer, Dubbo	20	4	9
W. Ellison, fruiterer, Emu Plains	7	0	0
T. Freeman, refreshment room, Penrith	5	12	0
G. Granger, fruiterer, Dubbo...	16	1	0
W. Hill, fruiterer, Wallerawang	7	9	0
Wright, Heaton, & Co., agents, Warren	5	12	0
R. C. M'Kinney, auctioneer, Hay	23	8	6
H. Kuhner, fruiterer, Bourke	14	16	0

	£	s.	d.
J. Meade, fruiterer, Ipswich, Queensland	12	2	6
Montgomery and Sons, agents, Sydney	11	5	0
J. Rowling, fruiterer, Nyngan	5	18	0
A. M'Roy, fruiterer, Nyngan	5	14	0
H. Simpson, fruiterer, Murrumburrah	12	2	0
Sweeney & Co., fruit exchange, Sydney	27	8	0
J. Tilmie, fruiterer, Warwick, Queensland	3	12	0
A. Thompson, fruiterer, Molong	34	13	0
W. Reed, fruiterer, Townsville	16	15	0
A. White, fruiterer, Nyngan...	6	0	0
Williams and Colless, agents, Bourke	4	0	0
A. Johnstone, fruiterer, Hay	88	3	0
	£470	9	6

This account is exclusive of the summer fruit; that is about £80 a year, which I reckon pays the labour for the year. I attribute the good results to irrigation. The figures do not include the quantity of fruit sent away, and omit to give any charges for cases, transportation, &c. The labour is calculated at £80 per annum, and is paid for by summer fruits. Then there is no calculation of interest on capital invested, horse-feed, wear and tear, &c. If these calculations were made, no doubt Mr. Dempsey's gross income of £470 9s. 6d. would be materially lessened. This sum gives a gross earning for the 8 acres of £58 16s. 8d. per acre, a very handsome return indeed. Counting all charges at the highest figure, and allowing for fluctuations in price, it can be reduced by one-half and still leave a handsome profit. There is not the slightest reason to misdoubt Mr. Dempsey's figures. Several of his trees yield as much as £4 or £5 worth of fruit each year. He considers the great yield of the orchard is due to irrigation, and probably this is true, but it must not be forgotten that the orchard was established before ever irrigation was thought of in the district. Mr. Dempsey's orchard is well worthy a visit. It is seldom that one can see so clean and handsome an orange grove. I have much pleasure in recommending him for the First Prize in his class.

Mr. Edwin Smith, Rosedale, St. Ives, 5½-acre orchard. Recommended for Second Prize.

This orchard is situated at St. Ives, Gordon, and is composed of the ordinary soil of the district. It has a fair depth of surface loam, with a gravel and clay subsoil. For planting the land was cleared and dug over to a depth of 15 inches. The trees are planted 18 feet apart, and it contains 485 orange and lemon trees, most of which are now 21 years of age. The land has been drained by pole drains, although it has a good slope. The trees are all remarkably healthy, and give good results for the labour bestowed upon them. The orchard is worked wholly by hand labour, the fork, hoe, chipping-hoe, and spade alone being used. It is manured every alternate year by the addition of about 18 lb. of bonedust to each tree. Scrapings from the bush are also added, and any other manure that can be gathered up about the place. The property is well fenced, and is well sheltered from the west and south by the natural forest of the country. There are surface drains for keeping the rainwater from coming in contact with the butts of the trees, which seems to be a very necessary precaution on sloping hill sides, as the water is collected and run off the land, and the land kept from washing, and the bark of the trees kept dry. Mr. Smith hands in the following statement of his year's operations, and it will be seen that he sets down £150 for working

5½ acres of land, whereas Mr. Dempsey only allows £80 for 8 acres. Mr. Smith allows nothing for subsidiary aids, although, as a matter of fact, he has considerable summer fruit, butter, and eggs, &c. I consider Mr. Smith deficient in implements. Hand labour is all very well, and in his case has given grand results, he having cleared £11 per acre on 5½ acres of land, without calculating any subsidiary aids, which he might have done. But his labour bill for the area of land under cultivation is a very large one, and might be materially lessened by the employment of a light plough, cultivator, and a "nuggetty" horse. The house and grounds are neatness itself, and the trees show great care, and notwithstanding his deficiency in implements, I do not feel that I would be justified in passing Mr. Smith over in favour of a younger orchard, when his trees, at their age, are so healthy and remunerative. I have much pleasure, therefore, in recommending Mr. Smith for second prize in this class.

The average sales for fruit, on account of the low prices realised, was £5 per week, being the lowest average for years past, amounting to £260, less £199 10s. expenses, leaving a credit balance of £60 10s.

	£	s.	d.
£5 per week	260	0	0
Per contra	199	10	0
Balance to credit	£60	10	0

	£	s.	d.	
Expense of punt and market fees, about	6	0	0	per year.
Working tools, about	1	10	0	,,
Horse feed, wear and tear, about	30	0	0	,,
Wear of carts, about	2	0	0	,,
Expenses of artificial manure, about	10	0	0	,,
Beside home-made manure	....			
For wages, about	150	0	0	,,
Total	£199	10	0	,,

Mr. A. F. Wooster, Carlingford—6½-acre orchard. Highly Commended.

This orchard is situated a short distance from the railway station, Carlingford. The land is on a rise, and is fair ordinary soil, with a gravel and clay subsoil. It was prepared for planting by breaking up 18 inches deep with a pronged hoe, the soil being left in its natural position, only broken up. About two-thirds of the land is drained 2½ feet deep and 36 feet apart, with 2 and 3 inch pipe, and in some cases 1½-inch pipes are placed in branch drains. The trees were planted 18 feet apart each way, and are now 6 years of age, and are principally Siletto and St. Michael oranges, and Emperor and Thorny mandarins. The orchard, so far as it has gone, shows good results, and the plants are remarkably healthy, and well cared for.

Mr. Wooster shows considerable skill and ingenuity in saving and conserving manure. In his stables he dissolves a quantity of the sulphate of iron in water, and mixes it with saw-dust, and uses it for bedding for his horses. The sulphate of iron is credited with fixing the ammonia in the horse manure. Gum leaves are also used for horse bedding, and then the whole, with the horse manure mixed, is placed in a shed to rot and decay. All other waste material about the premises containing fertilising ingredients is added to this heap, and when decay has proceeded sufficiently in order to admit of application to the soil it is used. Bonedust to the extent of 5 or 6 cwt. per acre is used, as are also scrapings from the bush. Flushings from tan-

neries are used with good results, only as it comes from the tanneries it is generally too crude for immediate use, and is better after being placed in a heap to rot and disintegrate for a time before application to the land.

Insect pests have not been very troublesome up to the present, but sometimes the fruit is fumigated to correct any latent disease. Mr. Wooster considers that fumigated fruit keeps better, because insects are destroyed, and the skin is better dried out.

The tools and implements are of the most modern description, and very suitable for the work in hand. There is a Planet Junior Cultivator with all the appliances and a reversible plough, with chipping-harrow, horse-hoe, roller, hand impliments, spring-cart, and dray. The packing-shed and store-room is capacious and substantial, and in fact every appliance is on hand for the economical and convenient handling of the fruit.

For insects there is the cyclone spray-pump and appliances. The dwelling house is a most substantial brick structure of six rooms, and is very neat, commodious, and containing all the modern conveniences. There is a brick cottage for the hired men, poultry-house, &c. A substantial paling-fence surrounds the property, and the gates are good. When the trees come into full bearing the orchard promises to be a model, and Mr. Wooster brings a good deal of sound and advanced agricultural knowledge to bear upon his business. The following statement of profit and loss for the year, gives a credit balance of £124 18s. 5d., for 6½ acres of land for the year's operations, something over £19 per acre of profit.

Cr.	£	s.	d.	Dr.	£	s.	d.
593 gin-cases oranges... ...	106	2	0	Wages...	62	0	0
515 „ lemons... ...	125	10	8	Manure	20	0	0
171 „ mandarins ...	52	19	6	Loss of cases	9	8	4
26 „ passion fruit ...	5	5	0	Commission, freight, interest, &c.	75	0	0
Fruit retailed	1	10	0				
	£291	6	9		£166	8	4
				Cr. Balance... ...	124	18	5
					£291	6	9

You will please note that this balance-sheet is for the year ending 30th April, 1892. I always calculate from the 1st May, because the crops are not divided then. Of course I could easily give you the figures for the year 1892.

Mr. E. T. Osborne, Rosedale Orchard, Thornleigh, 9-acre orchard, commended.

This property contains 12 acres, 9 acres of which are planted to trees, principally lemons and oranges, but there are about 3 acres of mixed fruit-trees. The trees range from 4 to 9 years of age. The land was prepared for planting by ploughing 7 inches deep, then digging with a fork about the same depth in winter, and at the same time manuring with about 12 cwt. of bonedust per acre. The trees are planted a little too close together, but they have made good growth and show good results. The land is a strong brown loam with a stiff red clay subsoil. The surface is undulating, and to catch and divert the surface water open shallow drains have been dug, but no subsoil covered drains have been made. The surface drains have a good effect in keeping the surface water clear of the butts of the trees, which Mr. Osborne considers a great advantage as it obviates root-rot. The land is principally worked by the chipping-hoe, hoe, forks, and digging hoes. There is a four-roomed frame cottage, out-buildings, &c., on

the property. The fencing is paling on two sides, and there is fair natural shelter. There is a horse and cart and harness. The number of trees on the premises are: Oranges, 144; lemons, 700; apricots, 25; peaches 150, and plums, 125. The statement of accounts shows sales amounting to £544 3s. 6d., less expenses £340 12s. 6d., leaving a credit balance of £203 11s., or £22 12s. 4d. per acre. I recommend Mr. Osborne for a commended certificate. His orchard is a very good one, although deficient in drainage and working appliances.

Account of Sale, 1892.

	£	s.	d.
Lemons, winter crop, 1,650 cases, @ 3s. 3d.	268	2	6
Lemons, summer crop, 335 cases, @ 8s.	134	0	0
Oranges, 180 cases, @ 5s. ...	45	0	0
Plums, 110 cases, @ 5s. ...	27	10	0
Peaches, 76 cases, @ 6s. ...	22	16	0
Apples, 70 cases, @ 4s. 6d. ...	15	15	0
Passion fruit, 24 cases @ 5s....	6	0	0
Vegetables, preserves, and sundries	25	0	0
	£544	3	6
	340	12	6
	£203	11	0

Expenses.

	£	s.	d.
Wages, one man...	65	0	0
My own labour	80	0	0
Manure and lime	50	0	0
Fruit cases	20	0	0
Tools	4	10	0
Horse feed	15	0	0
Interest on money	45	0	0
Commission for sale of fruit ...	61	2	6
	£340	12	6

Mr. John Kenny, Vanceville, Turramurra, 4½-acre Citrus orchard.

The surface soil of this orchard is a good brown loam, of fair depth, with, in some places, a pipeclay subsoil to a depth of 3 feet. The orange-trees are 10 years of age, some of them 9 years, and some of them 8 years old. There is one acre of very fine lemon-trees. The land was prepared for planting by breaking up 18 inches deep, and the trees were planted shallow. The orchard is well drained, 3 feet deep and 18 feet apart. Some of them are of tile, but the most are broken stone drains to a depth of 18 inches. The stones for these drains are broken to a size of 2 inches, and they act well. The land is worked by hand implements, digging in winter and chipping in summer.

The land has been manured with 3½ tons of manure per acre—600 lb. kainit, and superphosphates and bonedust in alternate years, with occasional dressing of sulphate of ammonia. The kainit, Mr. Kenny says, contains something like 33 per cent. of common salt, and he therefore does not care for it. The orchard is well fenced, and it has a good water supply in the shape of a creek. Mr. Kenny shows considerable skill and intelligence as an agriculturist, but his appliances for working the land I consider deficient. I consider Mr. Kenny's orchard a very good one, and improvements in the way of labour-saving appliances would place him in the front rank as an orchardist.

Mr. J. W. Farlow, Freeman's Reach, 7-acre Citrus orchard.

This property is beautifully situated on a gentle hill bordering the low lands of Freeman's Reach. The soil is a light loam surface, and a shale subsoil. Mr. Farlow has but recently acquired the property. Since it came into his possession he has ploughed it twice a year and harrowed and scarified it twice a year. It has been hand-worked around the trees. It has received no manure other than the grass which grew on its surface which was gathered up and placed around the trees as a mulch. There is no drainage other than a deep cut in the road in the brow of the hill on which it is situated, and one drain in the lower corner. The orchard appears to be worked in connection with a farm of 150 acres owned by the Farlow family. It contains no buildings of any kind. It is securely fenced, but appears to me to be lacking in shelter, except natural shelter from the west. The orchard appears to advantage, and the trees are remarkably clean and healthy though they are still young. Mr. Farlow seems to have improved the orchard considerably since it came into his hands, and it promises well. The following is Mr. Farlow's statement of accounts from which it will be seen that the total receipts from the property in 1892 amounted to £100 10s. 9d. from which must be deducted working expenses, which are not stated, but they could not be less than about £10 per acre, which would leave £30 to the credit of the orchard for the year. An orchard of this kind, although it may be a good one, has a poor chance of competing against a property of equal merit, which has improvements in the shape of dwelling-house, outbuildings, &c., on it. It is deficient in various ways notably in saving manure, conservation of water, shelter, and drainage.

	£	s.	d.
Planted August, 1884; labour, with hoe and horses to 1st January, 1885 ..	1	2	6
From 1885 up to 1st January, 1886	4	7	6
From 1886 up to 1st January, 1887	4	11	0
From 1887 up to 1st January, 1888	4	16	0
From 1888 up to 1st January, 1889	4	18	6
From 1889 up to 1st January, 1890	4	14	0
From 1890 up to 1st January, 1891	5	3	0
From 1891 up to 1st January, 1892	5	13	0
Interest on money paid out, and pruning orchard	3	15	6
	£39	1	0

Cases of oranges and lemons sent to market, 1887; 25 cases realised ...	5	12	6
Cases of oranges and lemons sent to market, 1888; 85 cases realised ...	14	16	0
Cases of oranges and lemons sent to market, 1889; 190 cases realised ...	36	0	0
Cases of oranges and lemons sent to market, 1890; 284 cases realised ...	50	7	6
Cases of oranges and lemons sent to market, 1890; 560 cases realised ...	60	15	0
Cases of oranges and lemons sent to market, 1892; 1,200 cases realised ...	100	10	9
	£268	1	9
Interest received	16	2	6
	£284	4	3

Class II.—10 acres and over.

Mr. William Waddell's Townhead Orchard, Singleton, 20 acres. Recommended for First Prize.

For the following outline of facts respecting the orchard I am indebted to Mr. Fell, Mr. Waddell's son-in-law, the lessee:—

"On the property is built a substantial one-storey brick house, containing eleven rooms, with detached kitchen and outhouses, situated on a rising knoll, overlooking the orchard, having a carriage drive with ornamental trees on either side, leading from the Maitland Road. There are also provided fruit-packing house, fruit-case and tool-shed, buggy-house, cart-shed, stables, hay-shed and piggeries, &c., about 12 acres being allotted to house and grass paddocks. The whole property is securely guarded by a 6-foot paling fence, and prickly-pear hedge, which runs parallel with fence; the fence is provided in convenient places with strong and substantial painted gates.

It comprises about 20 acres devoted entirely to members of the Citrus family, and about 35 acres are allotted to peaches, pears, apples, plums, nectarines, apricots, and grapes; all the several varieties of each different kind of fruit being well represented."

It is with much pleasure that I supplement the information given by Mr. Fell, by adding my testimony to the untiring energy displayed by Mr. Waddell in planting, and the skill evinced in keeping this large orchard in efficient health and cultivation. Some of the Citrus trees in the orchard are now 45 years of age, and while some of them show signs of decay, the greater number are still in health and vigour. As many as twenty-five cases of oranges are sometimes picked off one tree, and some of the trees are 15 inches in diameter at the butt. The soil is a rich black sedimentary vegetable mould several feet in depth, with a sand, gravel, or drift subsoil, a deposit by the Hunter River, to which it is adjacent. Here and there elevations of a light sandy loam have formed, which answer the conditions of plant life admirably, as upon these formations the crops are always early. The whole is fenced by a substantial fence and a cactus hedge, which affords excellent shelter to the trees. The implements are of the most modern description, and the cultivation is done wherever practicable by horse-power, the trees being planted 30 feet apart each way in the younger portion of the orchard, while in the older portion they are from 20 to 25 feet apart. The average crop is about 3,000 cases of oranges. For the repression of pests a very serviceable spray pump is in use, with tanks and all complete. Mr. Fell has added an agitator to the apparatus, which keeps the liquid in motion by the working of the pump, and so ensures an equal quality to the whole solution. In dry seasons the orange-trees are watered from tanks, and they are kept mulched with saw-dust, which answers that purpose most admirably, and works down in a fine mould. Taken as a whole, Mr. Waddell's orchard is one of the most interesting it has ever been my lot to inspect. Interesting in the great age of the trees that have been kept remunerative all these years, and which furnishes valuable data as to the life of the orange-tree in Australia. It would be interesting to note the effect of drainage on these trees. Certainly they are on land that is generally thought to be sufficiently porous to admit of natural drainage; in fact, such land as is not drained in any part of the world. But at the same time, I believe drainage would act beneficially on this orchard in staying the disease that is now manifesting itself in some of the trees.

As to the profit and loss for the season's operations, the following Dr. and Cr. statement by Mr. Fell will be interesting.

Dr.	£	s.	d.	Cr.	£	s.	d.
To labour	176	6	2	By orange crop	565	8	7
,, cases, &c.	41	2	2				
,, transportation	2	0	0				
,, management	160	8	6				
,, wear and tear, &c. ...	8	0	0				
,, profit and loss	177	11	9				
	£565	8	7		£565	8	7

In the above statement it will be observed that £176 6s. 2d. is set down for labour on twenty acres of an orchard. This gives at the rate of £8 16s. 3d. per acre. Then there is a sum of £160 8s. 6d. for management. This gives £8 0s. 5d. more per acre, or a total for labour and management of £16 16s. 8d. per acre. There is nothing, however, set down for horse feed and manure, nor for interest on capital invested; but with all these items added, the figures are too high. It will be seen that the total profits of the 20 acres is set down at £177 11s. 9d., which is certainly a small amount, considering the size and excellence of the trees. Taken all round, the orchard is a very excellent one, and is well deserving the First Prize for which I have recommended it.

Mr. P. F. Richardson, Vernon Park, St. Ives, 14 acres. Recommended for Second Prize.

This property is situated on the Cowan Road, about 2 miles from Pymble Station, on the Hornsby to St. Leonards railway. It is only a little over ten years since the first clearing was made, and its present state shows what can be accomplished in a short time by energy and skill.

The total area of the property is 27 acres, which is surrounded by a good post and rail fence, the part occupied by the orchard (about 14 acres) being secured on all sides by a paling fence, which protects it completely from the inroads of hares, rabbits, and other destructive animals. On the south and west it is well sheltered by a row of *Pinus insignis*, filled in with pittosporums, camphor laurels, &c.

The dwelling-house consists of seven rooms, including kitchen, and has a wide verandah on front, back, and east sides. There is also a dairy, larder, wash-house, and wood-shed, as well as an office and a room for the incubator, &c.

In the yard there is a stable and shed for general use, with a carpenter's bench (as all repairs are done as far as possible on the premises) on the one side, and on the other there is a large room for packing and sorting the fruit, a men's room, a closed-in coach-house, with a loft overhead, also an open cart-shed, where cases are stored, and a shed for storing potatoes, and feed, or bonedust, with a fire-place for preparing the fowls' and pigs' food when required.

There are two 1,500-gallon tanks and a well 30 feet deep by 10 feet diameter, bricked round more than half way down, which give an ample supply of water for all purposes in the driest season.

A considerable portion of the orchard has been drained with 2½ and 2-inch pipes at a depth of 3 feet, and the remainder has open drains about 18 inches deep and 38 feet apart, which are being sunk to 3 feet and laid with pipes as quickly as time and opportunity will permit.

In the way of tools, all the usual orchard and garden requisites are in good supply. In addition there is a small Planet Junior Cultivator, which has

proved of great service, saving much time and labour. One man can do more in a day with it than three men with the ordinary chipping hoe.

The orange and lemon trees, and most of the other fruit trees, are planted 19 feet apart. The trees are in excellent health, while great care and skilful attention has been paid to the pruning and shaping of the trees. This is more particularly observable in the orange and peach trees, which are very regular and symmetrical in size and shape.

The manures used are bone-dust of extra quality, obtained from Mr. Charlish, of Willoughby, and the Colonial Sugar Company's No. 4, which is most suitable, and a perfect manure for the purposes required here. Besides these manures, everything in the way of rubbish, bush leaves, &c., is mixed with the stable, cow and fowl manure, and used as required. It is found of great value in improving the character of the soil, which is generally rather poor and hungry, without much depth, and requires constant working and attention, but this is repaid by the extra fine quality of fruit produced. The whole orchard is dug and manured every year, with the exception of some of the summer fruits, such as apples, &c., among which the plough is used, but Mr. Richardson considers that ploughing is injurious to the Citrus trees, except when young, as it is very severe on the surface roots.

The fruit when picked is sorted and carefully packed and marked, according to quality, before being sent to market, so that the agent can sell according to the market, and is able to get a better price than if it was carelessly packed without sorting. He (the agent) reports that the oranges sent from here this year were the best he received from the district, and that he always obtained the highest market price for them.

Next to the oranges and lemons come the peaches, which do well, and in the early kinds, such as Briggs May, Waterloo, Early Alexander, Early York, &c., the fruit has always held its place amongst the buyers in Sydney.

The Japanese date plums succeed admirably, and it was from here first that the new and large kinds were sent to market a few years ago, before they were so generally grown.

The grape vines are trained on the French system, along wires, and produce a larger quantity of fruit than those trained in the ordinary way.

The vegetable garden merits special notice, as it is kept very trim and neat, and contains every variety of seasonable vegetable; asparagus, seakale, spinach, Globe artichokes, cucumbers, tomatoes, rhubarb, &c., do well, also rock-melons, custard marrows, and strawberries. There is a good sized pond at the bottom of the garden, surrounded with a very luxurious growth of pampas grass, the flowers of which sell well in Sydney.

Outside the orchard there is a cultivation paddock of about 2 acres fenced off from the rest of the land, in which green feed, hay, &c., are grown.

Adjoining there is a cow-shed and piggery, a covered shed for saving the manure in, and another for cutting and storing firewood in wet weather.

There are also four good fowl-houses, with large yards, enclosed with wire netting, in which are to be seen about 250 head of poultry, principally Langshans and White Leghorns, with a few fine Pekin ducks. The hatching of chickens is principally carried out with one of Hearson's incubators, which is started about the end of July, and closed the end of October. Mr. Richardson finds that the chickens raised from the incubator are quite as strong and sometimes better than those hatched and brought up by the hens, and it is especially suited for rearing ducks.

I should also mention that there are twenty stocks of Ligurian and Hybrid bees, but this has not been a good season for honey, so that very little has as yet been obtained.

The results of the operations for the year just ended will be seen in the accompanying statement of income and expenditure, and when the age of trees, the character of the soil and other conditions, more especially the low prices obtainable for all sorts of fruit during the last twelve months, are taken into consideration, it must be freely admitted that the balance to the credit of profit and loss is more satisfactory than could have been anticipated.

I am indebted to Mr. Richardson for the above very full and accurate description of the property. The soil of the orchard is not the best in the district, yet the best has been made out of it, as will be seen by reference to the following statement of the year's operations. It will be seen that off 14 acres of land, most of the citrus trees being only from 7 to 8 years of age, Mr. Richardson makes a profit of £172 12s. 1d., which amounts to £12 6s. 7d. per acre, which is about double the amount of profit derived from Mr. Fell's much older and full-bearing orchard. He, however, does not pay so much for labour by more than one-half as that paid by Mr. Fell. Nevertheless, it would be altogether nonsense to place Mr. Richardson's orchard before Mr. Fell's in the prize-list. Probably, if Mr. Fell's orchard had been entered as a mixed orchard, it would have shown better commercial results. It will be seen that much more than half the amount of Mr. Richardson's receipts came from products other than Citrus fruits.

Income.	About.							
	s.	d.	£	s.	d.	£	s.	d.
Oranges, 306½ cases, average price...	6	1½	93	13	6			
Lemons, 156 " "	4	6¾	35	18	6			
" 15 " held over	5	0	3	15	0			
Peaches, 325 half cases	4	4	70	12	5			
Nectarines, 49 "	4	0	9	18	6			
Apricots, 14 "	4	0	2	17	0			
Plums, 14 "	7	9	5	9	0			
Date plums	......		6	3	3			
Grapes	......		4	15	5			
Apples, 67 cases	4	9	16	0	0			
Sundries, including loquats, figs, &c.	......		17	19	6			
Violets	......		12	19	2			
Vegetables sold	......		4	18	0			
Honey	......		4	12	6			
Bacon and ham, 220 lb., house account	0	9	8	5	0			
House—milk and butter, per week, at	10	0	26	0	0			
" fruit and vegetables "	12	0	31	4	0			
" honey	2	6	6	10	0			
Value of manure made from stable, &c., 80 loads	4	0	16	0	0			
Poultry and eggs, deducting cost of food...	......		37	9	10	415	3	7
Expenses.								
Labour, one man all and one part of year	......		96	10	0			
Manure	......		26	0	0			
Commission on sales, including cases	......		23	8	6			
Tools bought...	......		3	15	0			
Horsefeed, &c., per week	10	0	26	0	0			
Cow feed, per week...	4	0	10	8	0			
Sundries, repairs, garden seeds, &c.	......		7	10	0			
Interest on capital, taking land at £70 per acre...	......		49	0	0	242	1	61
Balance to credit of profit and loss ...	......		......			£172	12	1

TABLE showing the points obtained by the various competitors.

	ORCHARDS UNDER 10 ACRES.												10 ACRES AND OVER.			
	H. Dempsey, Emu Plains		C. Smith, St. Ives, Gordon.		A. F. Wooster, Carlingford.		E. F. Osborne, Thornleigh.		J. J. Kenny, Turramurra.		T. W. Farlow, Freeman's Reach.		W. Waddell, W. J. Fell (lessee).		P. F. Richardson, St. Ives.	
	Maximum points.	Points awarded.	Maximum points.	Points awarded.	Maximum points.	Points awarded.	Maximum points.	Points awarded.	Maximum points.	Points awarded.	Maximum points.	Points awarded.	Maximum points.	Points awarded.	Maximum points.	Points awarded.
Selection of trees suitable for district...	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
General cultivation and cleanliness	100	85	100	85	100	80	100	85	100	80	100	80	100	95	100	95
Training and pruning of trees...	100	95	100	95	100	85	100	90	100	90	100	80	100	95	100	95
Repression of pests	100	95	100	90	100	90	100	85	100	90	100	85	100	95	100	95
General commercial results and system of book-keeping ...	100	100	100	90	100	95	100	95	100	75	100	70	100	85	100	95
Method of planting trees, preparation of land, choice of site	100	95	100	95	100	90	100	95	100	95	100	90	100	95	100	80
Conservation and intelligent application of manure... ...	50	40	50	40	50	50	50	40	50	50	50	...	50	40	50	40
Selection of best available position for each kind of tree grown	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
System of underground drainage	50	25	50	25	50	35	50	10	50	50	50	15	50	*	50	30
Conservation and application of water, where available ...	50	50	50	40	50	25	50	25	50	10	50	...	50	35	50	20
Shelter—artificial or natural	50	40	50	45	50	15	50	30	50	25	50	10	50	50	50	40
Economy in working, including implements...	50	45	50	25	50	50	50	35	50	25	50	40	50	45	50	40
Excellence of varieties of fruit	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Utilising surplus fruit and other subsidiary aids	50	25	50	20	50	20	50	25	50	15	50	25	50	40	50	35
	1000	895	1000	850	1000	835	1000	815	1000	805	1000	695	1000	875	1000	865

* None necessary.

Report on Bee Farms.

ALBERT GALE—Judge.

I have the honor to submit my report upon the bee farms competing for the National Prizes offered by the Department of Agriculture. The number of entries was nine in the first class, those containing 30 to 100 hives; and five in the second class, those having 100 hives and upwards, in all a total of 14 entries, being an increase of 4 upon the entries of 1891. One competitor, who sold his apiary, and another whose farm was so damaged by floods as to almost destroy his chances of success, withdrew.

The arrangement of the two classes differs in this year's competition. For 1891, the first class was 100 colonies and upwards, and second class 30 to 100 colonies. For the competition of 1892 this order is transposed, those bee farms containing 30 to 100 colonies are termed first class, and those having 100 and over second class. Hereinafter, in each case where they are referred to, those apiaries of 100 colonies and upwards are designated A and those with 30 and under 100, B.

The prizes in class A were awarded as follows:—

First.—Mr. J. E. Taylor, Cowra.

Second.—Mr. William Niven, Eugowra.

Highly commended.—Mr. R. Macansh, & Co., Narara.

Commended.—Mr. W. J. Dockrill, Casino.

In class B.—

First.—Mr. Seabrook, St. Ives.

Second { Mr. Geo. James, Gordon.
Mr. B. Carlill, Casino.

Highly commended.—Mr. C. Mansfield, Largs.

Commended.—Mr. H. B. M'Farlane, Rooty Hill.

The points that were approved of by the Minister were the same as that for the competition for the year 1891. (For points see tabulated form, page 580). These were divided into sub-points, and each sub-point again divided by two, giving half points where necessary. Taking this arrangement into consideration, the points gained are really double what they appear to be. The value of the points was arrived at in the same manner as was the case for the 1891 competition, and the judging conducted by the same method and standard.

The total number of colonies in class A was 630, being an increase of 38 as compared with the previous competition. The total in class B was 511, being 249 more, or nearly double that of the former year; an aggregate of 1,141 and an increase of cent. per cent. The average for the year 1891 was 69·3 and in the last competition 73, being an increase of an average of 3·7. The highest number of points gained in 1891 was 81, and the lowest 38, and in the last competition 84·5 and 50 the highest and lowest respectively. An increase of 3·5 over the highest and 12 over the lowest of the previous year.

In the following table the average points gained in the competition of each year are contrasted :—

	91A.	92A.	91B.	92B.
General Arrangement	8·2	8·7	7·0	8·0
Strength, &c....	7·6	7·8	7·0	7·3
Handling	4·2	3·9	3·4	3·4
Home-made hives	7·8	7·9	7·4	8·1
„ appliances	7·0	6·5	4·0	6·1
Honey...	4·4	5·2	4·0	3·7
Wax	2·6	3·5	1·8	3·2
Nuclei...	4·0	3·4	1·6	2·8
Honey Plants...	1·8	0·8	2·0	0·8
Operating-house	3·2	3·0	2·0	3·1
Workshop	3·2	4·0	3·0	3·4
Extracting	4·4	4·1	3·0	3·5
Cleanliness	7·8	8·1	7·0	8·1
Enemies	10·0	9·7	9·2	9·2
	76·2	76·6	62·4	71·2

The first two columns A represent farms with more than 100 colonies and the last two B farms with less than 100, but more than 30. In columns A it will be noticed that there is a very slight increase of 0·4 only. Two of the competitors in class B were competing in 1891, and again in 1892—Mr. Seabrook and Mr. Mansfield—the former taking second prize with 70 points, and the latter, highly commended, with 68. The following will show progress made :—

	First prize.	Second prize.	Highly Commended.
B 1891......	78 points.	70 points.	68 points.
B 1892......	79 „	77 „	75 „

To gain highly commended eight points more are required this year than last; five points more than the number that gained the second prize in 1891.

In columns A the progress has been still greater (8·8) than in 1891. Three of the farms that competed in 1891 were again in the field, one had changed hands. The improvement is as follows :—

	First prize.	Second prize.
A 1891...	81·0	79·0
A 1892...	84·5	78·5

These figures show that the Second Prize was slightly lower, and that the improvement was scattered among the whole of the competitors. The most notable increases are in home-made appliances, arrangements of operating-house, and general cleanliness. That these three show the greatest improvement must be highly satisfactory to the honey-consuming public in that the article they buy under the label "Pure extracted honey" is from bee farms of known reputation for cleanliness, &c.

General arrangement of stocks, the cultivation of honey plants, and freedom from enemies, show a slight downward step, the last only by two-tenths. This was caused chiefly by two competitors, one who had sadly misunderstood the value of foundation comb, and it was found impossible to manipulate most of his hives. The other case was where all black bees are kept. There were not a great many moths, but enough to make him lose one mark. One or two moths in the pupa form in hives that had not been opened for some time, were also seen.

General Arrangement of Stocks.

An easterly aspect was that generally chosen. If two colonies are placed side by side, one facing east and the other west, that facing the east will commence work earlier in the day than its westerly neighbour, whilst the one facing west will continue to work later than the easterly one. But the easterly one has its advantages over the westerly. "The morning flowers display their sweets," and there are far more honey-secreting flowers that open in the early mornings than late in the day. East to north-west are the best directions. A westerly or southerly is too bleak in winter time, more especially on the table-lands. Most of the sites were well chosen. One or two farms visited were objectionable owing to force of circumstances. The situation of an apiary from which the best results may be obtained is on a small plain at the mouth of a wedge-shaped valley, the thin end of the wedge pointing southerly; or on a small plain situated at the bottom of a valley, and surrounded on every side by mountains. The flora of the same variety in such situations open consecutively, beginning low down in the most sheltered situations, and continuing to bloom day after day, higher and higher up the sides of the hills, long after those the bees had first worked upon are in seed pod. In such situations the honey flow of the different varieties of flowers in the same locality is continued much longer than is the case where the same variety of flowers bloom on a plain. In some cases the hives were exposed to the full influence of the sun, and not the slightest protection was attempted. Under such circumstances it is not the bees that suffer so much from the situation as the operator. Mr. Taylor and Mr. Niven have much improved their trellised vines, and in some cases trellised protections have been commenced by others. The circumscribed space of one or two apiaries was detrimental and unsightly, and the crowded way in which the hives were arranged must be a source of annoyance to timid visitors. Where the hives are in rows of not less than 12 feet apart, and about 6 feet from stock to stock, there is much more freedom for the operator as well as the visitor. In the cases referred to, where they have but a limited area to carry on bee-culture, dissimilarity of location is provided for by intermixing flowers and shrubs with the hives, thus ensuring the return of the queen to her own home after her nuptial flight.

Strength of Colonies.

This varied remarkably in early spring where the Italian blood predominates. Take these two cases, about 40 miles apart, both bee-farms located on the western slope of the Great Dividing Range, similarly situated and having the same floral advantages. I visited the former (Italian bees) on the 12th December, and found them in full spring vigour and activity, and swarming had been going on some weeks before my visit. Three days later I arrived at the farm of black bees; they had been well wintered, and during that season they had had plenty of stores, had recovered from spring dwindling but were only *preparing* for the swarming season. Still more remarkable is a case I met with at Murrurundi. I called in there on my return from visiting the northern competitors, and found that the Italian bee had only been introduced into the locality in the early part of the summer. Up to that time black bees reigned everywhere. I looked into some of the hives of black bees of an amateur bee-keeper and found them on the verge of starvation. I then visited another amateur not more than a quarter of a mile from the former. This bee-keeper had Italian bees, they were

obtained from Mr. Pender, of Maitland, who took the first second-class prize in 1891. Here the black bees were able to live, but there was no surplus honey. Nevertheless, the owner had obtained 120 lb. of honey from his Italians, although the eight or ten colonies of black bees in the same garden had not given him a pound.

The discarding of drone comb from the brood-chamber is systematically carried on, perhaps a little too much so, in localities where the Italian bee has almost superseded the black. In such localities the purity of the drones should receive some attention so that the black bee in the bush should receive as much Italian blood as possible. The very black combs from the brood-chamber are more frequently destroyed by some bee-keepers than formerly, and empty worker comb from the honey chamber substituted. I know, that black comb is a vexed question, both in America and here. That a working bee whose metamorphosis has taken place in a much used brood cell is smaller when it emerges is admitted, and it is asserted that in the earlier periods of its imago life it rapidly grows. In a letter before me are these words, "The workers are characterised by a peculiar fluffiness at birth, and are somewhat small, but increase quickly in size during the first three or four days after emerging." A bee whilst in a chrysalis form, in a brood-cell just before it emerges *completely fills the cell,* whether the cell be in a virgin state or has many old cocoons lining its walls. If such be the case, and it is so, how is it possible for that bee to *re-enter that cell* with such perfect ease as we so frequently see them, if they have grown after they have emerged from it? For an imago insect to grow is contrary to the laws of insect life.

Wiring is becoming a thing of the past, being rapidly superseded by a centre bar. It is quicker to insert this bar than to wire, and it secures the comb whilst the honey is being extracted equally well. In like manner one pound sections are being superseded by half sized supers, the latter being more profitable to work than the former.

In the hands of amateurs the strength of colonies is largely disregarded. A queen and 5,000 or 6,000 workers is calculated as a workable swarm. One hive from 25,000 to 30,000 will gather more honey and winter upon less stores than half a dozen colonies of 8,000 inhabitants each. The necessity for equal or natural spacing, having the boxes perfectly plumb, and the fixing of foundation comb-starters, appears to give amateur bee-keepers the greatest amount of trouble to understand.

Handling.

The subduing of bees by the aid of smoke is not so generally carried on as formerly. A few bee-keepers who are old in experience frequently handle bees without its aid. If carefully handled and honey be coming in freely there is little to fear. Various materials are used to produce smoke—rotting wood, old bagging, rags, thick brown paper, old cotton-waste that has been used to clean machinery, and cow-droppings. This latter must be perfectly dry, when it has advantages over all other, for it consumes away slowly, produces a good smoke, and is sparkless. In two or three cases the bees were very irritable. In one instance this was caused by an accident, and by a bush fire not far off. The worst case was where no blankets were used and the bur comb had glued the top of the bars to the cover of the hive. This bur comb is a great source of trouble and annoyance, and a great waste of labour for the bees. I have for a long time been on the look-out to see if I could discover the cause of such an apparent waste of time, labour, and material. I find, after examining some hundreds of

frames covered with it in various parts of the country, that bees have a very justifiable reason for their bur comb proceedings. Comb built by bees in a state of nature—that is, where no foundation is used—has holes, frequently called "pop" holes, at irregular distances, for the purpose of permitting the bees to pass from one side of the comb to the other, instead of being compelled to descend to the bottom, to reach the point required by ascending the other side. If a burred comb bar-frame be examined it will be seen that it is chambered with galleries having frequent openings on either side. The reason, therefore, undoubtedly is to form passages so as to pass from one side of the comb to the other, without having the trouble to always descend to get to the other side. To counteract these passages, I made some frames with thick top bars perforated with elongated holes, large enough to admit two bees to pass each other. From reports I have received from bee-keepers who have been using them, the improvement has proved successful. Holes made of tin, and inserted in the comb, will answer the same purpose. In opening hives where no blanket is used, it too often happens that the operation is accompanied with a sudden jerk, and the anger of the bees aroused, to the danger of the operator and onlookers.

Home-made Hives and Bar-frames

are now in general use with the more experienced bee-keepers. 'In one case only were professionally made bar-frames used. The work is carried on in the winter evenings. In many of the workshops I saw small circular saws, that showed signs of being well used. With the aid of these saws, almost every inch of the wood of old packing cases, bought from country store-keepers, can be utilised. Where railway or water carriage is not available the saving is very considerable.

Home-made Appliances.

Some of the less experienced competitors seemed to lose sight of the usefulness of appliances, and substituted quantity in lieu thereof. In one case a competitor went to work armed with implements of bee torture rather than appliances of utility, and boasted of his dexterity in using them. There were knives for cutting the frames from the sides of the boxes; others designed for loosening them from the bottoms of hives, and levers for lifting out the frames. In his case the implements were absolutely necessary, on account of the spaces between the bar-frames and the bottom and sides of the boxes being so great that the bees had used it for comb-building. Some of the appliances in use were very interesting and novel in their use. A catalogue of the various appliances used on the various bee-farms would be an interesting study to inventive minds for the purpose of bringing out appliances that would be found of service in the hands of most bee-keepers. A very good and useful wax-melting can, made by Mr. Nevin from two tin-billies, rendered first-rate service, and answered well the purpose for which it was designed. There was also a light four-wheeled hand waggon, fitted by Mr. Halsted for carrying smoke-bellows and other appliances, and having ample space for holding frames for the purpose of taking them to and from the extracting-room, and a machine, by Mr. McFarlane, for lifting heavy hives for the purpose of renewing the bottom boards, &c., all of them well worthy of a place in other apiaries.

Honey.

The points given for honey in 1891 were—extracted 2, comb 2, 1-lb. sections 2, = 6 points. Owing to the difficulties in packing comb-honey for transportation last year, I left out the two points given for it, and, in lieu thereof, gave 4 points to extracted honey. This alteration met with the general approval of all the competitors, as honey in the comb is not nearly so profitable as the extracted article. The system adopted for testing its purity was the same as that followed in 1891, but the method of bringing the various samples together into one place for comparison differed. In 1891 the various samples were all sent to Sydney, and there adjudged. I afterwards learnt that it was possible, and even probable, that at least one of the samples forwarded was not gathered from the neighbourhood of the apiary from which it was said to have been. To frustrate any possibility of a similar fraud, I had the frames taken from the hives, and the honey extracted and bottled in my presence, and placing it in my hand-bag, brought it away with me. By this means I was assured that the honey I had was the article gathered and marketed from that particular district, although, perhaps, the samples were not as ripe as they otherwise would have been had the competitors forwarded what samples they thought fit. Some years ago it was a usual thing to see honey exposed for sale under the headings "bush honey" and "pure garden honey." The former could be purchased at a much lower rate than the latter. Bush honey differs not in flavour, consistency, or colour, from "pure garden honey" obtainable in the same district, the many impurities that are always to be met with in bush honey, made it so inferior that it became a drug in the market. The method of running garden honey differs in no respect from that of straining bush honey from the comb. The foreign matter it contains is the same, excepting that in the "bush honey" there are fragments of the decayed trees in which the bees' nests were found. Bush honey and garden honey are obtained from the comb in the same primitive fashion, *i.e.*, straining through a bag after the honey-comb and all it contains, honey, bee-bread, and bees in every stage of development, have been crushed to a pulp. These in conjunction with an adulterated article that has been largely imposed upon our honey consumers from foreign markets, have had all to do with the non-consumption of honey for dietary and domestic purposes. Honey, says Virgil, is "Heaven's gift, food fit for the gods," but it must be remembered that he wrote in a period before the adulteration of food had become an art. It is only within the last few years that the bee-keepers have commenced a campaign against the wholesale practice of adulterating honey. Only the product extracted from flowers by bees can be called by, and sold under, the name of honey. Not all the sweets that are gathered, placed in the cells, and sealed over by the bees can be designated by that name.

Frequently in the honey cells, glucose, fruit-sugar, sugar-cane, Swiss table-honey (a manufactured article), conifer honey, aphidian honey, &c., are to be met with, especially so in a season when flowers are yielding little or no nectar, or when bees have been artificially fed. Dr. Haenle, in his report to the Apicultural Congress, held in Strasburg in 1890, wrote, "Up to five years ago a thick mist hung over the chemistry of honey." The mist is rapidly being swept away. The Australian public are being gradually educated to know that the honey from our apiaries sold under a label bearing the words "Pure extracted honey from ——— apiary" is "heaven's gift"—honey extracted by bees from flowers, and flowers only. Among the samples of honey I have in my possession, all gathered from Australian or introduced

flowers, there are some that have all the qualities and flavours that were sought for before the introduction of cane sugar. The honeys of Crete, Minorca, and Narbonne, are flavoured with rosemary. The honey from Hymettus, so celebrated by the ancients, is flavoured with thyme. The grateful flavour of the honey of Provence is due to the flowers of the lavender. The honey of Cuba owes it delicious perfume and taste to the oil of neroli, obtained from the orange groves in which the bees work. The early spring honey from the district around Sydney is highly celebrated for the same flavour. The honey from our white, red, and yellow box ranks highly in consistency and colour, and the agreeable flavour imparted to it is due to the volatile oils of the various species of trees from which it is gathered.

If we can rely on the published statistics of the results of bee-keeping both in Europe and America, New South Wales should indeed be proud of her honey harvests, as compared with those of the continents above named.

The following is an extract from one of the Sydney newspapers:—"The world's honey producers.—The largest bee-keeper in the world is Mr. Harbison of California, who has 6,000 hives producing 200,000 lb. of honey yearly. In Greece there are 30,000 hives producing 3,000,000 lb. of honey; in Denmark, 80,000, producing 2,000,000 lb.; in Russia, 110,000, producing the same; in Belgium, 200,000, producing 5,000,000 lb.; in Holland, 240,000, producing 6,000,000 lb.; in France, 950,000, producing 23,000,000; in Germany, 1,450,000, and Austria, 1,550,000, each producing 40,000,000 lb. of honey. But in the United States of America there are 2,900,000 hives belonging to 70,000 bee-keepers, and producing 62,000,000 lb. of honey yearly."

The following is the average quantity of honey produced by each hive in the various countries named:—Greece, 10 lb.; Denmark, 20; Russia, 18·2; Belgium, 25; Holland, 25; France, 24·2; Germany, 27·5; Austria, 25·5; United States of America, 21·5.

The 2,900,000 hives of the United States of America are owned by 70,000 bee-keepers, being an average of nearly 42 for each one, and we can see the average quantity of honey from each hive is but 21·5 lb. The 12 bee-farms that I visited, wintered 862 hives, an average of nearly 72 each, and the quantity of honey produced by them was 122,042 lb., an average of over 140 lb. per hive, being 6·5 times more than was obtained by the average American bee-keeper, and nearly 6 times more than that produced by any country in Europe.

As already stated the largest bee-keeper in the world is Mr. Harbison, and the results of his honey harvest are quoted above. His average is 33·3 lbs. per hive. If we take two of our bee-keepers who obtained the largest yield of honey last season, Mr. Taylor and Mr. Niven, the former obtained from 105 hives, 17,920 lb., or an average of over 170 lb. per hive, and the latter from 136 hives, obtained 24,640 lb., being an average of over 181 lb. per colony. The largest quantity of honey taken from a selected hive on Mr. Taylor's farm was 250 lb., and from Mr. Niven's, 253 lb. 10 oz. The 862 hives referred to are those that were carried through the winter of 1891. The aggregate number of hives adjudged during this inspection was 1,141, being an increase of 211 over last year. It must be borne in mind that at the farms visited in the early part of my inspection, the swarming season had only just commenced, and in two cases had not begun.

The following information is taken from a diary kept by Mr. Niven, recording the rise and progress of his bee-farm, and goes to show how successfully the bee industry may be followed up:—In 1885 he had twenty colonies in common boxes. 1885 to 1888 were good seasons, and the bees

gathered large quantities of honey, and threw off many swarms, but bee-keeping was not a success, the bees not having sufficient hive-room. In 1888, 127 colonies, sixty of them in bar-frame hives, but the whole were neglected, owing to Mr. Niven following other occupations. The season 1888-1889 was a very bad season for his bees; sixty colonies were destroyed by the bee moth. (Was it not the neglect, and not the season that was the cause of the destruction?) In the end of the season 1889, he had seventy-eight colonies and very little honey coming in. The bee moth again became troublesome, which, by the end of August, 1890, had reduced the apiary to sixty-six colonies. "We have now made up our minds to make bee-keeping pay, or abandon it altogether," are the words following this entry. In October there was an increase of one colony, but the bee moths still continued their ravages. By November, there were 110 stocks doing well, and gathering honey of a very good quality, which sold at 5d. per lb. in Sydney market. In 1891, there were 124 hives, and the quantity of honey gathered was 7½ tons, being an average of 135½ lb. per hive. At the end of season 1891-1892, 10 tons 19 cwt. 11 lb. of honey had been obtained from 134 colonies, an average of 183 lb. for each one. If California, the greatest honey-yielding country mentioned, was equally as good a honey-producing country as New South Wales, the 6,000 hives referred to should have yielded 1,098,000 lb., instead of 200,000 lb., or 898,000 lb. more than stated.

It may be interesting to note the debit and credit sides of the accounts of bee-farm the first year, when the Niven's had "made up their minds to make bee-keeping pay." The following are the results of the season 1891-1892:—

Receipts.	£	s.	d.	Expenditure.	£	s.	d.
Value of honey sold	140	0	0	6 months labour for self ...	58	10	0
Value of honey in stock ...	135	0	0	Assistant	15	10	0
Beeswax	11	0	0	Wire	0	1	10
23 swarms (sold) @ 30s. per hive	34	10	0	Solar extractor	1	5	0
				Cases for making hives ...	1	14	0
				Lime for white-washing ...	0	4	0
				Barnes' circular saw	10	0	0
				Bee journals	0	13	0
				Small articles	1	0	0
					£88	17	10
				To profit	231	12	2
	£320	10	0		£320	10	0

Nuclei for Queen-raising.

Five points. Classes A and B obtained an average of nearly three. In class B, Mr. Chas. Mansfield, Largs, and Mr. J. E. Taylor, Cowra, obtained the full number. Queen-rearing is the most important branch of the bee industry, and no bee-keeper can be considered a practical man without having a knowledge of a regular system of superseding his old queens by those reared by himself, or by purchasing. Queen-rearing may be classified as natural and artificial. By natural, I mean cases where an extra strong colony is made queenless, and as soon as the workers have constructed and capped over the larval queens, and removing them to the colonies as required, or in about twelve days after the queen has been so removed, inserting a frame containing brood comb, with newly laid eggs or larva. The younger the larva the better, the older the selected larva the shorter will be the

life of the queen that is bred from it. In these inserted combs, it is better if the eggs and larva be exposed by removing some of the walls of the cells. If there be plenty of nurse bees in the hive, the bees will build natural queen-cells. By artificial queen-rearing, I mean that method advocated by American bee-keepers (Doolittle, and others), and adopted by many of the Australians, viz., making queen cups of wax.

In a state of nature a queen cell is not made wholly of wax, but a large portion is built with a mixture of wax and pollen. The capping of brood comb, both drone and worker, is built of the same material. It would appear from the porous nature of queen cells and brood cappings that a greater quantity of air is required to develop a drone than a worker, and the queen bee whilst developing must have all the air obtainable by both abdominal and thoracic spiracles. Abdominal respiration in the breathing space given to the queen cell appears to be one of the chief agents in the development of the ovarium of a queen, while the contracted air-space and the air-tight wax walls of the worker cells appear to be the cause of the non-development of the same organs in working bees. In a pupal or larval state respiration in insect life is performed equally by all the spiracles, but chiefly by the abdominal. On account of the air-tight cells and the cocoons wholly enveloping working bees whilst in a larval state these abdominal spiracles are almost, if not wholly, prevented from working; but the thoracic spiracles come fully into play. The abdomen of an embryo queen bee is free from the encasement of a cocoon, and undoubtedly this is one of Nature's reasons why the larval queen has only her head so shrouded and so protected. Another reason for leaving the abdomen of the queen entirely undefended by such a covering is, that the imprisoned queen may become an easy victim to the one reigning. But this absence of cocoon from the larval queen's abdomen, the porous nature of the material of which the cell is formed—its shape an inverted cone; the cavities in the exterior surface of that cell (the convexities being given to add strength to its tissue-like walls); the position of the young queen within, the abdomen being higher than the head so that the air within the cell by the heat imparted to it by the incubating bees clustering around the semi-detached and pendulous royal cell, have more to do with the development of the generative organs of queen bees than feeding with larger quantities of food. "I claim," says Doolittle, "that the food fed to all larvæ up to the time they are thirty-six hours old, is exactly the same whether the larvæ are designed for drones, queens, or workers; and that the difference comes by the queen larva being fed with larger quantities of this food all of its larval life, while the others are fed sparingly later on, or else a different kind of food given after they are thirty-six hours old."

Newport has shown that the development of heat in insects depends on the "quantity and activity of respiration, and the volume and velocity of the circulation." Bees possess the voluntary power of generating heat by breathing faster.

Huber observes in an article on Insect Incubation, "The manner in which the bee performs her incubatory office is by placing herself upon the cell of a nymph (pupa) that is soon to be developed and then beginning to respire, at first gradually. In a short time the respirations become more frequent, until at length they are increased to 120 or 130 per minute; the fluff on the bees aiding in retaining the heat. The bodies of the incubating bees soon become of a high temperature, and on close inspection are often seen to be bathed in perspiration. When this is the case the temperature of the insect soon becomes reduced and the perspiring insects leave the cell, and others almost immediately take their places.

When respiration is performed less violently less heat is evolved. The same bee will often continue on the cell for many hours in succession." This extreme amount of heat is evolved entirely by an act of the will of the bee. All observant bee-keepers know that the colder the weather the more restless are the incubating bees on the brood comb. The heated air produced by these bees clustering on the brood comb cannot affect the abdomen of worker larvæ to the extent it does their head and thorax. Whilst, as before mentioned, the position of the royal cell and the porous material from which it is formed, the position of the royal inmate, and its freedom from an entire cocoon covering, the constantly changing position of the incubating bees that cluster around these royal chambers, are the agencies employed by Nature to fully develop the ovarium at the sacrifice of the honey sac, and produce that most interesting inmate of the hive, a queen bee. The absence of these agencies in the cells of the worker larvæ causes the development of the honey sac—the wax pockets and pollen baskets with which the working bee is provided—at the sacrifice of the ovarium. From the foregoing it will be seen that the conditions exacted by nature for the production of the all-important mother bee are not only extra food, but, in conjunction with it, extra air, extra heat, extra space, and another position to that of worker-larvæ. These extra conditions produce female bees capable of fertility. Their absence produces female bees incapable of fertility. All bee-keepers know that a bee capable of fertility is perfected from the laying of the egg to the time the chrysalis emerges from the cell in sixteen days. But, if all the conditions I have named be withheld, the same insect would have taken twenty-one days to mature, or five days longer than is required for the development of a queen bee.

I have been led into these remarks by observing the extraordinary artificial queen cups manufactured by some bee-keepers, and the instructions given for making the same in some books on scientific queen-rearing. A bee-keeper once showed me some artificial queen cups he had made, drawing my attention at the same time to their remarkable strength—that strength being their chief witness against them. Here are the words from a scientific work on queen-rearing:—"As soon as the wax on the cell (mould for making the cell) was cool enough to set, it was again dipped, not allowing it to go as deeply in the wax as it did the previous time by about the thirty-second of an inch, when it was cooled as before. In this way I dipped it from six to eight times, when I had a queen cup that pleased me, as the outer edge was thinner than the bees made theirs, while the base was so thick that it would stand much more rough usage than would cells built by the bees. . . . I find by measuring that I dipped the sticks in the wax nine-sixteenths of an inch the first time, measuring from the extreme point, and dipping less and less each time, as before stated, so as to get the base of the cell very thick, which I consider a great advantage." If the artificial queen cups are thicker than those made by bees they cannot be as porous as if they were made from wax. The thicker and deeper they are made the less chance will the bees have to build their natural additions thereto. I have now lying before me an artificial queen cup from which the imago has emerged. It is nearly one-sixteenth of an inch thick, very strong, and three-quarters of an inch deep, and before being given to the bees it had a plane surface. A natural queen cup under the same circumstances would be about one-eighth of an inch deep, and the concavities almost transparent. On the outside of this artificial fabrication the bees have tried to supply the conditions required by nature, by adding thereto a covering of the usual porous materials. To raise queens artificially is of the very utmost importance, but if all the conditions

demanded by nature be rejected it will be at the cost of the queen. It must interfere with her longevity and her fecundity. The shallower and more fragile the artificial cup is made, so that the bees can add all the requirements of nature, the better in every respect will be the queen so reared. In the early spring, when bees are eager to swarm, shallow artificial queen cups will be accepted, but this will not be the case later in the season.

A far greater amount of attention is now given to queen-rearing than was the case two years ago, and indeed a great stride has been made since last year. No bee-keeper will ever arrive at the apex of success who disregards this important branch of the industry. The competitors who have been most successful in this competition are in nearly all cases those that have given most attention to this subject. When it is considered that out of a colony of from 25,000 to 30,000 bees success or failure depends wholly on one of those inmates, the importance of queen-rearing cannot be overrated. Is it any wonder that under the old "gin case" method there are so many failures when we consider that we cannot introduce a new queen into them no matter what may be wrong. One might as well expect to get milk and butter from a cow 30 years old, or eggs from an ancient hen, as honey from hives containing an old queen. Whatever goes wrong in a colony it must be taken for granted that it is the queen's fault, and the sooner the queen of an unsatisfactory colony is superseded the better will be the results.

Some of the bee-keepers that I visited are as particular in selecting their queen bees as farmers are in selecting their stud sheep, cattle, and horses, or as a fowl fancier in choosing his pen of birds with whose progeny he expects to come off victorious at the next annual show. Before long queens will be selected by their points as much as a Devon bull or a merino ram now is.

At present the Italian queens hold the foremost place of honor, and justly so. The superior traits in their working stock are well known to most people—docility, fecundity, energy, and recovery of numerical strength earlier in spring; they are more easily manipulated, bear artificial swarming better, and are more defensive against robbers, bee-moths, &c., than other varieties. At present there appears to be four recognised strains of Italian bees, that I will here designate as A, B, C, D. Mr. C. Mansfield, Largs, who is an enthusiastic queen-rearer, is the only bee-keeper I ever met with who considers the honey harvest as only secondary to queen breeding. Possibly this is because the district in which he lives is not great in its honey-yielding plants, but is eminently conducive to the breeding of bees. The whole neighbourhood abounds in pollen-bearing plants—maize, millet, pumpkins, &c. At this apiary can be seen these four strains very distinctly. Messrs. Seabrook and Mansfield and some others are constantly importing new queens from Italy and America to improve the strains they already possess.

"A" is a bee from northern Italy, and is found in a state of nature in the basin of the rivers Po and Adige and in the plains of Lombardy. The dorsal rings near the thorax are tan colour, but vary in shade just about as much as the fashionable tan-colour boots do of to-day. The extremity of the abdomen is very dark, almost black. The second abdominal ring is very wide transversely, and the abdomen tapers abruptly downwards. These characteristics are indicative of a largely developed ovarium. They are remarkable for quietness, gentleness, and docility. Indeed, it is not an unusual thing for the queen to be seen depositing her eggs while the comb is in the hands of the manipulator. The working bees from this strain are very pretty. The width of the abdomen of the queen descends to the workers, showing that the honey sac has a great capacity; they are active and vigorous, and have the character of being great honey gatherers.

"B" is a queen narrower and longer, and possesses all the external distinctions of "A," excepting that of the width of the abdomen, and the workers are not so aldermanic. They are equally energetic, but their honey-carrying capacity cannot be so great as the workers from the strain "A." In a bee-keeper's eye the difference is almost as great as between a thorough-bred racehorse and a Clydesdale.

"C" is a queen of a bright golden colour, and a native of Southern Italy. This strain is met with on the lower slopès of Vesuvius, and on all the southern portions of the Italian peninsula. From their colour the strain appears to have a large share of Cyprian blood, but from their docility one may argue against such a supposition. They are equally as prolific as "A," but the form would indicate that this fecundity is not so lasting. The workers of this strain are not so energetic under all circumstances, or, to put it in Mr. Mansfield's words, "the strain is a first-rate good-times bee but is not so much of hard-times sort as "A." The beauty and usefulness of this bee may be retained if crossed with "A." Mr. Taylor's queens appear to be of this type, and the best of the queens I saw among the competitors at Casino were somewhat similiar. Our beekeepers are hard at work, and are unwittingly raising a bee that will become an "Australian strain."

"D" is a Doolittle queen (unfortunate for the busy bee to receive such a name). If "A" and "B" are pretty, "C" and "D" are perfectly handsome. I have never seen a queen come up to the form and beauty of a Doolittle queen that I saw at the Hunter River Apiary, at Largs. The head and thorax were beautifully formed and full of animation, the whole of the abdomen, excepting the merest tip, a richly burnished gold, and the whole insect as lady-like as a princess. In fact it was a bee that might be trotted out at any time for exhibition purposes; nevertheless I am doubtful if she be as useful as she is handsome.

Beeswax.

The samples of wax were far superior to that of 1891; the average points then gained were 2·2, and for this season they are 3·6. The dirty grey wax that was so frequently exhibited has now almost disappeared. There are three distinct grades of wax—white, straw colour, and deep yellow—each one having its own value. The aim with all bee-keepers is to produce as clear a white wax as possible for exhibition purposes. White wax is mostly used by artificial flower and fruit makers and in other branches of the fine arts. The straw colour wax is the favourite with makers of artificial foundation comb. The most valuable from a commercial point of view is the deep yellow. It is not an unusual thing for white wax to be coloured with annatto. I find from inquiry that the wax-dealers in England will give a ton of bleached (white) wax in exchange for a ton of pure deep yellow. The profits they make are derived from the adulterations. Yellow wax always realizes a higher price in the home market than the paler colours or white.

The Cultivation of Honey-producing Plants.

Less has been done this year than last in the way of obtaining a regular yield of honey by the cultivation of plants solely for that purpose. It has been proved beyond doubt that to till the soil for the growth of such plants as will give a crop of honey only is in no way remunerative. But where that cultivation will give two crops, one of grain or seed and one of honey, it will pay to grow crops for that purpose. Some of our largest and most successful bee-keepers are amongst our smallest land-owners, and others are on small areas, and have no fixity, &c., of tenure. Where a person goes fully

into bee-keeping combined with the cultivation of the soil, the grain harvest too frequently interferes with the honey harvest. Agriculturists, orchardists, and florists sow the crops and the bee-keeper reaps the honey harvest. This is but a fair division of profit. The crops that the cultivators of the soil produce are chiefly entomophilous, they are dependent wholly upon insect life for the removal of the pollen from the anthers to the stigma, for the purpose of fertilization. The most important diurnal insects that nature employs for this purpose are the bee family, and honey-gathering bees are pre-eminently useful for the fertilization of fruit crops. Blossoms that open late in the evenings or at night are fertilized by moths. Bees are in reality our forest makers, fruit producers, and florists. No bees or other insects (but chiefly bees), no fruit. Last year the largest area that was put under crop for honey was 1½ acre of Japanese buck-wheat. This year the largest area was a few square yards only of the same grain. Most competitors had a few sample plants of either borage, salvia, serradella, or sunflower, but nothing that might be regarded as a crop. The indigenous vegetation is what the bee-keeper has to rely upon for his honey harvest. Dividing the colony into its three natural geographical divisions, I found upon inquiry that the bee-keepers on the coastal district favour blue-gum, blackbutt, stringy bark, and spotted-gum as producing the greatest quantity of honey, while the best quality honey is produced by the blackbutt and clover. On the northern rivers of the coast district red-gum, black tea-tree, and mahogany yield the greater quantity, and the honey from the black tea-tree is the most superior. On the table-lands white box is preferred, both as regards yield and quality. On the western slope of the Great Dividing Range and on the great plains white box and river gums are the favourites for quantity, and the white box the superior for quality. The average number of points gained in the season 1891–92 were two each out of five for this section; and in this last season the average was only one out of the same number. The bee-keepers do not believe in raising crops for honey and honey only.

Arrangements of Operating Houses.

The operating houses in general have improved. The average number of points gained are 3·1, maximum 4½, minimum 2, as compared with 2·5 of last season, maximum 4, minimum 1. Nevertheless, there is ample room for improvement, more especially in class B. Any kind of material is made to do duty for the purpose of putting up those very essential buildings, old iron and wood that has been used for other purposes half a dozen times over, and full of bolt-holes giving free ingress and egress to all the vagabond bees in the neighbourhood. In other cases there were no bee escapes, so that if the door should happen to be shut, as is frequently the case, the robbers are completely imprisoned, the death of hundreds being the result. One competitor, Mr. James, of Gordôn, has around the base of each post of his operating house cemented circular troughs filled with water, for the purpose of making it ant-proof; an improvement that could be adopted by other bee-keepers with great advantage. It is an effectual remedy against the ravages of pests. Workshops fitted with carpentering tools were found with all competitors. There were no make-shifts, as on my previous visit, and only one or two of a temporary character. The improvement gave nearly a full mark all round more than that of last season. One in class A obtained full marks. Small circular saws were in use in nearly every workshop. In two cases the gearing of old corn-shellers had been utilized, all with one exception were driven with a treadle, the exception being that of Mr. Carlill, of Casino, whose saw was driven by means of horse-power. The shops, for

most part, were well arranged; every tool being in its place and easily found. Boxes or drawers containing the various sized nails and other small materials used in making appliances were labelled and within easy reach of the workman, the work being carried on with ease and system.

Cleanliness and Neatness.

As in the last competition so in this—there is a large difference between individual competitors. In the competition of 1891–92 the highest number of marks gained was nine, and that in one case only, and the lowest four. In 1892–93 four competitors gained nine points each, the lowest number of points being seven. Trellised grape-vines overhead are far more general than formerly. In some cases the culture of the vine for shade purposes is in its infancy. Of course, it will take time to bring to the perfection of utility, as is the case in the apiaries of Mr. Taylor or Mr. Niven. At one place visited the hives were, for the most part, placed under trees and arranged along a paling fence. To any one unaccustomed to work among bees it looked very neat, and appeared to give the best of protection to the hives from the heat of the noonday sun. The branches of the trees were so low, especially where supers were in use, that it was next to impossible to get underneath to fully inspect the inmates of the hives. The overcrowding observable last year was also met with this year, notwithstanding there was ample room where it occurred for the establishment of a much larger bee farm. The spaces occupied by the apiaries are well and neatly laid out. The hives were interspersed with a few ornamental flowers, or picturesquely arranged along gravel paths, that were scrupulously free from weeds, or dotted over small well-trimmed lawns, thus giving an air of attention which indicated that the very great interest taken by the proprietors in the insects was not altogether a selfish one of greed, but that bee-keeping was to them a very interesting as well as a profitable pastime.

Not the slightest sign of disease was noticeable. From inquiries made in the districts I visited, foul-brood appears to have been fairly stamped out of the apiarics of the competitors. On completing my tour of inspection, I immediately visited the Dubbo district, where I saw unmistakable signs of the disease above referred to. A few cases of paralysis were also met with, but not amongst the competitors for the National Prizes. A want of care in keeping the inner side of the bee-hives and their surroundings free from cobwebs, had caused the destruction of a good number of bees in going from and returning to their homes. Bee-moth is almost an enemy of the past with the bee-keepers of to-day—I refer to those having bar-frames. Those who still persevere in keeping bees in any make-shift box will never be free from them. The destruction caused by this well-known bee-enemy is largely contributed to by bee-keepers themselves, if such a term may be applied to those who put bees in a box, and bestow no thought or attention upon them from year's end to year's end, or only when they expect to reap an abundant harvest of honey. The sole causes of the ravages of the bee-moth are boxes with entrances everywhere, numerically weak colonies, robbing them too late in the season, leaving them no time to gather in their winter stores, and general carelessness and neglect. The remedy is the antithesis of these: Well-made bar-frame hives, having but one entrance; strong colonies of Italian bees (this bee is far more defensive than the black); when extracting late in the season, seeing that there is a sufficiency of honey for the winter's consumption; a regular and general supervision of the hives, and a lively interest in the general welfare of the bees, treating them as pets, and always seeing to them as you would any other valuable live stock.

Interesting Facts.

Amongst B Class competitors, two only prefer the pure Italian race, and one of them preferred the northern or leather-coloured to its more southerly neighbour. The reason given was that they were by far the best workers, were steadier on the comb under manipulation, are more gentle than any other known bee, build up quicker in the spring, and recover earlier from spring dwindling. Another competitor of this class had a preference for the southern bee for the same reasons. The remainder of Class B have a much stronger liking for the so-called hybrid, *i.e.*, German or common bee crossed with the pure Italian. In one instance preference was given to a Carniolian-hybrid Italian again crossed with a pure Italian drone, in this way producing a bee having two-thirds Italian and one-third Carniolian blood. Among the five competitors in Class A only one of them gave an all-round advantage to the hybrid. Another thought the hybrid worker commenced to store earlier in the spring, and the pure race better in the autumnal season. The experience of the remaining ones was that no variety of crosses came any way near the purest Italian race, and from information I received from bee-keepers who were non-competitors the verdict in favour of the purest of the Italian race is a just one. The pure Italian races are more suitable for the warmer districts, and the so-called hybrids for the colder parts of New South Wales. The term hybrid is a misnomer as applied to the cross between the black and Italian bee or the Carniolian bee and Italian. A hybrid is a mule or mongrel, an intermediate individual between two species. A species is a conception subordinate to a genus with attributes extending to fewer individuals. Instead of the term hybrid we should use the word variety, *i.e.*, something varying or differing from others of its kind. Hybrids are seldom fertile, or rarely remain so for any length of time, whereas varieties are frequently more prolific than the parent on either side. A hybrid is the mixture of two species, a variety the mixture of two individuals of the same general kind. A far more comprehensive term would be that of yellow-banded bees; thus, we could say the variety is one, two, three, &c., &c., banded.

In class B the wholesale price of honey was from 3d. to 4d. per lb., and class A sold at from 3½d. to 5d., averaging nearly 4½d., and the average of B nearly 3¾d.

There appears to be a general consensus of opinion as to the most suitable kind of season for the greatest supply of honey. A dry summer following a wet spring will be sure to be followed by a good honey flow. A wet autumn, dry winter, showery spring, followed by a dry summer, was the kind of season that produced the greatest yield of honey that one bee-keeper had ever known. The experience of another was that the honey obtained in a dry season is always darker and not so saleable as that obtained in a wet one.

It would be as well if all bee-keepers kept a diary of the seasons, and also the dates of flowering of all honey-producing plants. I obtained the following authentic information on the subject from Mr. Dockrill, of Casino. The dates can only have reference to the northern coast district:—Red gum, from July to August; red ironbark, from July to September; prickly tea-tree, from October to November; small-leaf tea-tree in December; apple-tree, from January to February; bloodwood, from February to March; mahogany, in November; white box and swamp tea-tree, in April; flooded gum, in May; spurwood, in June and July. From the above it will be seen that no month passes without one or more of the indigenous trees giving a crop of honey.

STATEMENT showing Points obtained by the various competitors.

		CLASS A. First Prize, £15. Second Prize, £10.					CLASS B. First Prize, £10. Second Prize, £5.						
	Maximum.	J. E. Taylor, Cowra.	W. Niven, Eugowra.	R. Macansh and Co., Narara.	W. J. Dockrill, Casino.	F. A. Maxwell, Albury.	Seabrook and Co., St. Ives.	B. Carlill, Casino.	Geo. James, Gordon.	C. Mansfield, Largs.	H. B. M'Farlane, Rooty Hill.	J. Halsted, Eglinton, Bathurst.	F. Drummond, St. Lawrence.
General arrangement of Stocks	10	9	9	8	8½	9	9	8½	8½	7	8	7	8
Strength of Stocks	10	9	7	7½	8½	7	8½	9	8½	9	7	7	5½
Handling	5	4½	4½	3	3½	3½	4½	4½	3½	4½	3	2	2
Home-made Hives and bar-frames ...	10	9½	7½	8	8½	6	4½	8½	7½	9	9	8½	7
Professionally made ditto ditto	5	...	...	...	...	...	2½	...	...	...	...	...	...
Home-made appliances	10	6	7½	6	7	6	8	6	7	7	7	8	...
Professionally made appliances... ...	5	...	...	...	...	...	...	...	...	...	...	...	...
Stored Honey (purity not quantity) ...	6	5½	6	5	3½	6	4½	3½	3½	4	3½	4	3
Beeswax	4	3½	3½	3	...	4	2½	4	3	3	4	2½	3½
Nuclei for Queen rearing	5	5	2	3½	4	...	3	4	4½	5	4	...	...
Cultivation of honey-producing plants ..	5	2	2	½	½	1	1½	...	1	½	1	1½	...
Arrangements of operating house ...	5	3	3½	4	2½	2	4	3½	4½	2	2½	2½	3
" workshop	5	5	3½	3½	4	4	3½	3½	4	3	2½	4	2½
Freedom from enemies and disease ...	10	10	9	10	10	9½	10	10	10	10	9½	10	5
General cleanliness and neatness ...	10	8	8½	9	8	7	9	9	8	7	8	9	7
Extracting in presence of Judge... ...	5	4½	5	4½	4	2½	4	3½	4	4	3	3½	2½
Total	100	84½	78½	75½	72½	67½	79	77½	77½	75	72	69½	50

Poultry.

By SAMUEL GRAY,
Sub-Editor.

The Plymouth Rock.

Of the many breeds produced by the ingenuity and patience of Americans, certainly none have been more successful or more highly appreciated than the Plymouth Rock. This breed is the outcome of one of the many attempts to produce the ideal bird—a bird which as a layer shall equal the best laying varieties, and as a table bird shall equal the best table varieties. That complete success has crowned this effort I cannot admit, but that a great step has been made towards this goal will be frankly acknowledged by all experienced breeders.

According to Lewis Wright, the first authentic account of the modern Plymouth Rock was given in 1871, when Mr. W. Simpson, of West Farms, New York, refers to them as an "improved Dominique." In a communication dated in 1873 the same gentleman refers to them as "single-combed Dominiques crossed with Asiatics." Whether the cross used was the Cochin or the black Java is immaterial for our purpose here in Australia, neither will it be necessary to go into the difficulties which beset the early breeders. I do not by this statement wish to convey the idea that it is a simple matter to breed perfect birds, far from it. Quite as many difficulties exist as in the case of other equally-established breeds. But there is at the present day less tendency to "sports" than was the case when the breed was first fixed as a type. It was then a common occurrence to get chicks which were quite black, but the present-day chicks from well-bred parents generally come out "cuckoo."

There is one curious fact in the breeding of Rocks which it is worth while to remember. The Americans have studiously bred their birds with a view to reducing the size of the markings, so that the plumage has become what is known as "barred." This has had a tendency to make the American bird considerably lighter in colour. The English breeders, on the other hand, appeared to prefer the heavier markings, which partake more of the character of a "spangle," and the English bred birds, the hens particularly, appear very much darker. This difference in shade, however, is merely a matter of taste, and the main point on both sides of the Atlantic is distinctness. There is a strong tendency of the markings degenerating into a smoky or cloudy feathering, and the prevention of this is one of the difficulties with which the Plymouth Rock breeder has to contend. In this country, although the Rock possesses a coat of "good wearing colour," the effects of a hot sun soon become apparent. It is quite common, particularly when there is an absence of shade, for the plumage to turn rusty, and this is a point which any person desiring to keep the breed should pay attention to.

It must never be forgotten that the main idea in breeding the Plymouth Rock was and is to obtain a bird of an eminently useful type. In order, therefore, to be successful, it will, at times, be advisable to overlook slight defects in marking in favour of size, symmetry, and laying qualities.

The chief quality which the Plymouth Rock has to recommend it to the farmer is rapidity of growth. Numerous carefully-conducted trials have proved its superiority in this respect. The weight for cocks is from 9 lb. to 12 lb., and for cockerels 8 lb. to 11 lb., and my own experience has proved that a healthy cockerel will often give a pound in weight for each month of age. Such a bird should certainly be sold for table purposes at per pound, and I am under the impression that this system has been adopted by Mr. J. W. Pender, of West Maitland, one of the largest importers and most successful breeders of Rocks in New Sonth Wales. As regards their laying qualities, I would refer to a table which appeared in Vol. III, part 12, at page 1028, which shows that the Rock held its own very fairly, even against the Leghorn, during the three coldest months of a Canadian winter.

There is no doubt they do very well in almost any part of this country, and they are very hardy birds. Like all rapidly maturing birds, they are large feeders, but being as well good foragers, their appetite, in view of their size, is certainly no detriment. The hens, which lay a good-sized brownish egg, are not great sitters, and once during a season is usually enough for them. Great care is required in selecting hens for this purposes, as I have found it necessary in many cases to keep the hen away in order to prevent her gobbling up the "tit bits" intended solely for her family, and some mothers will leave the chicks too soon. Their dispositions, however, vary considerably, and I have also found hens which made excellent mothers. It will thus be seen that the Plymouth Rock can be kept for all purposes, and this I claim as another point in its favour.

The breed of fowl which has no weaknesses or failings is one which I have never yet come across, but in this respect also the Plymouth Rock comes well to the front. The only thing it appears to be subject to is a sort of rheumatism in the legs. I believe this may be prevented to a great extent by giving the birds a perfectly dry roosting-house and a well-drained run. Another point which I consider of great importance for all heavy birds is to keep them on *low* perches; 3 feet from the ground is quite high enough. It may be added that with proper attention Rocks do very well in confinement.

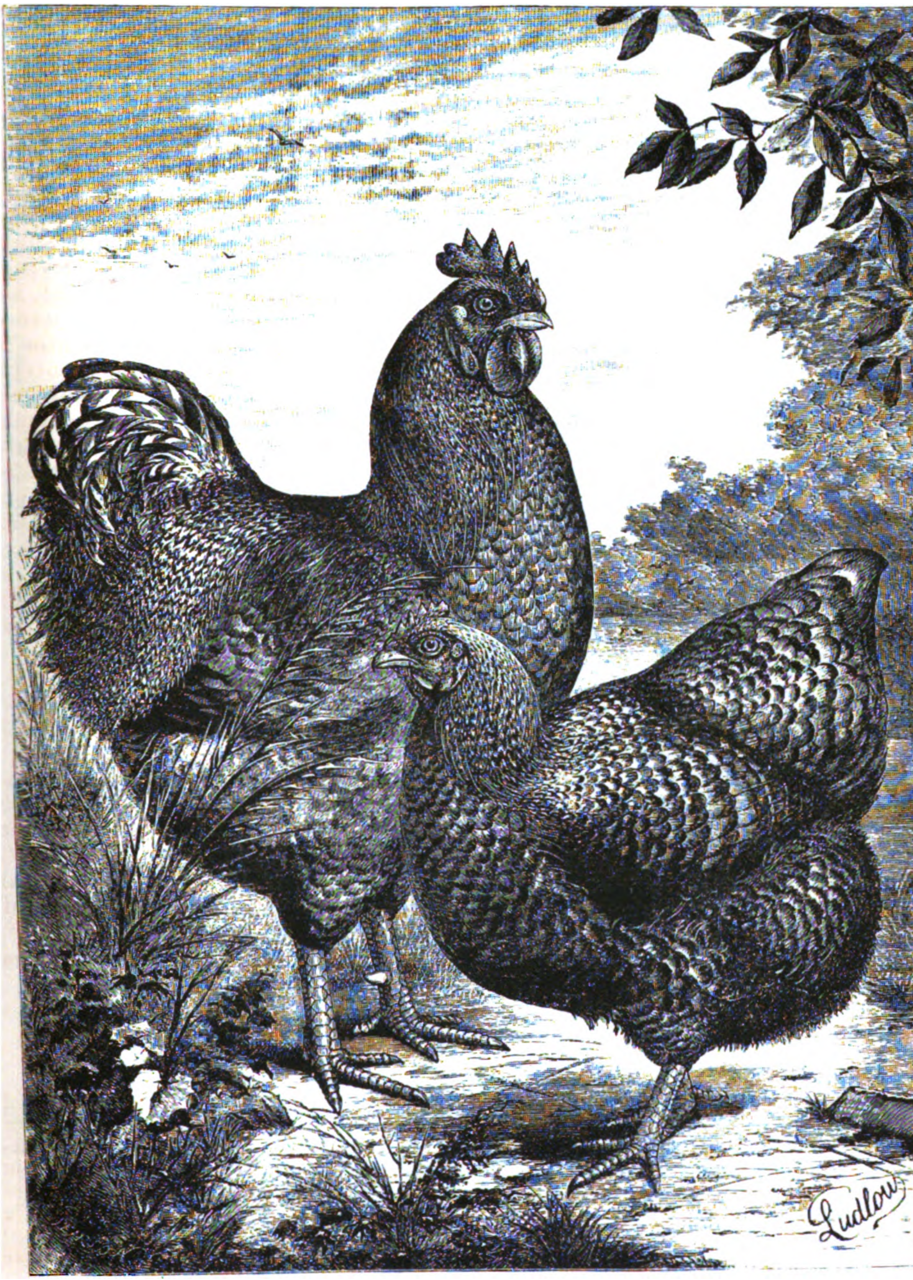
Amongst the breeders in New South Wales probably the most successful prize-takers are Mr. J. W. Pender, of West Maitland; Mr. H. Cadell, of Tamworth; Mr. T. Hall, of Fairfield; Mrs. W. H. Webb, of Bathurst; Mr. G. B. Moran, of Pennant Hills; Mr. S. R. Watkins, of Seven Hills; and Mr. W. F. Weeks, of Wentworth Falls.

The Plate and the following schedule are taken from Lewis Wright's work:—

General Characteristics of Cock.

Head and neck.—General appearance of head resembling a Cochin. Beak short and stout at base, somewhat resembling a parrot's bill; comb single, upright, medium-sized, neatly-arched, perfectly straight, free from excrescences, fine in texture, and symmetrically notched or serrated; wattles rather long, thin, neatly rounded, and fine in texture; deaf-ears well developed and pendent; neck rather short, well arched, and very full of hackle, causing it to appear very wide at the shoulders and tapering at the head.

Body.—General appearance large and deep; back, broad and short; saddle rather broad, with a gradual rise to the tail, as in Cochins; wings medium-sized and neatly carried; well buried in the body-feathering; breast very deep, broad and full; the Cochin breast to be avoided.



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PLYMOUTH ROCKS.

Legs and feet.—Thighs, large and strong, well furnished, but not fluffy; shanks rather short, very thick, and set on wide apart, to be perfectly free from feathers; toes large, straight, and well spread out.

Tail.—Rather small, but larger than Cochins; furnished with two sickles, but smaller than usual.

Size.—Very large, ranging from 9 lb. to 12 lb. in cocks, and 8 lb. to 11 lb. in cockerels.

General shape.—Massive, but compact.

Carriage.—Upright and commanding.

GENERAL CHARACTERISTICS OF HEN.

Head and neck.—Resembling the cock's, with the usual differences.

Body.—Somewhat more plump and square than the cock's.

Legs and feet.—Similar.

Tail.—Rather small, and rising almost upright out of a rising saddle.

Size.—Averaging (say) 7 lb. or 8 lb.

General shape.—Square and massive, yet neat.

Carriage.—Very plain and matronly, with a dignified air.

Colour.—Beak, bright yellow; comb, face, deaf-ears, and wattles a brilliant scarlet red; shanks, bright yellow; plumage, a bluish-grey ground, pencilled or barred across the feathers with bands of dark bluish-grey, verging to black. Depth of colour in cockerels, and bright marking as fine as possible in hens, desirable.

STANDARD OF PERFECTION.

A bird perfect in shape, style, colour, &c., and in perfect health and condition, to count in points	100
If of extraordinary size, add on that account	5

DEFECTS TO BE DEDUCTED.

Bad comb and head	12
Want of hackle...	10
Bad shape or carriage of tail... ..	6
Primaries out of order...	15
Curved toes	7
White in deaf-ears	6
Faults of plumage	20
Want of size	20
Want of symmetry (especially of breast)	15
Want of condition	15
,, ,, (if total)	35

DISQUALIFICATIONS.

Legs feathered, or any colour but yellow. Red, white, or black feathers. Wry tails, or any other deformity. Birds not matching in pen. White ears. Any fraudulent dyeing, dressing, or trimming.

NOTES.

The Breeding Season.

By the time this appears the hen-birds intended for the season's breeding in temperate districts should have been penned off for about a month, and such eggs as they may have laid used for cooking. The cock may now be introduced, and under ordinary circumstances, the hens will be clear of all previous impregnations, and, moreover, will be anxious for his attentions. It is very essential that birds used for chicken production shall be of strong constitution and in vigorous health, and three or four hens will be quite enough to allow to each cock-bird. This insures greater fertility in the eggs and stronger chicks. It is a great mistake to allow a large number of hens, as although more chicks may be hatched out from the pen, the mortality will be much greater, and eventually there will remain only a few miserable chicks, as against a fair average of chicks with excellent constitutions.

As regards the pens, it goes without saying that they should be kept thoroughly lime-washed, and that the droppings should be constantly removed from the roosting houses. There are some small matters which are constantly overlooked by farmers when breeding poultry. It must be remembered that when fowls have unlimited range they find for themselves

almost every essential for keeping them in healthy condition. When they are shut up, however, there are many necessaries from which they are cut off. As a consequence, it is customary amongst experienced breeders to fix up a shade, either of corrugated iron or brush, about 3 feet from the ground, and forming a roof only. Under this are placed the drinking water, a box of dry earth and ashes for a dust bath, and a little box containing sharp grit, crushed bone, and oyster shells. The shade should cover sufficient space to permit of the birds resting beneath it out of the sun, in addition to covering the articles above enumerated. Care must be taken that fresh green food is provided in each pen daily, and it is a good plan to give the birds a good sized turf to scratch at. An occasional feed of good sound oats will be found beneficial to the hens.

Although it is preferable to have the pens ready in July still there are parts of this country where breeding will probably commence later. A few words therefore as to the building of breeding pens may not be out of place. A fair size, where space permits, is to have the wide enclosure, say, 30 feet by 8 feet. In order to save wire, and prevent birds getting either out or in, I have adopted a height of 4 feet, and then the same width of wire may be utilised for wiring over the top. Such a pen does for all kinds of birds, whereas without a roof it would be necessary to go up at least 10 feet to keep in Hamburgs, Games, and the like strong-winged birds. While the roosting and laying-house should not be too much closed up, arrangements should be made to give the laying hens as much privacy as possible.

In order to insure accuracy each pen should have a distinguishing number or name, with which each egg should be marked when being removed, and a record should be kept of the number of eggs obtained daily from each pen. A few moments' consideration will show in how many ways such a record will be valuable. It will serve to show the laying qualities of the particular breed or breeds; it will enable the breeder to check the mortality amongst chicks, as well as the fertile qualities of the males and females used; and it will be of great assistance to a breeder who may sell settings of eggs in calculating returns, and guiding him in arranging his pens for another season. Another point which should not be forgotten is that it will bring about methodical habits, cause increased interest, and so benefit generally the poultry industry.

Practical Vegetable-growing.

Directions for the Month of August.

Settlers in the country districts very seldom trouble themselves about growing vegetables for the use of their families, and seem either to fail to recognise the importance of good wholesome vegetables for food, or else do not know how to grow them or what to grow, or perhaps considering that the time likely to be occupied in their cultivation, could be better employed at other, apparently, more remunerative work. The fact is, however, that but very little time need be set apart for this work if a proper system be followed, and an abundant supply of wholesome food can be produced at but little cost. Even a few vegetables would be better than none at all. The only difficulty will be to enclose a small piece of ground and make it proof against the various animals common to an ordinary farm. When this necessary work has been done, vegetable-growing will become easy enough, and a very few minutes intelligent work a day, occupied in this enclosure, should soon show excellent results.

With a view to encouraging the growth of home vegetables a few simple directions will be given every month in the *Agricultural Gazette*, and the various habits of different kinds will be explained so that there need be no difficulty for anyone who can read, to understand the various necessary operations.

In order to attain success in vegetable-growing it is absolutely necessary that the ground be well drained and thoroughly well dug, the deeper the better so long as the surface soil is kept as much as possible on the top 6 inches. If the ground can be dug 18 inches or 2 feet deep so much the better; but if the subsoil is brought to the top, it will, in most cases take a long time before it becomes properly fit for use. The more level the ground the better the vegetables will grow, and if not naturally fairly so the various beds should be made as level as possible. It is a curious fact that seeds will come up better on level ground than on a slope. When enclosing the land make it as square as possible, and let all the beds be square also for this will save a great deal of time and trouble in the long run. Another most important matter to bear in mind is that all vegetables should be planted or sown in rows. A beginner who attends carefully to these matters will soon get into the habit of regularity and system, and when this is attained half the battle is over. A small portion of the enclosure should be set apart for a seed-bed in a rather shady situation, say, the southern or eastern side of the fence, but not on any account under the shade of living trees. In this small space various kinds of seeds such as cabbage, lettuce, cauliflower, leeks, celery, and others can be reared for planting out in the garden. Directions for all these things will be given from month to month. There should be no difficulty in providing a good heap of manure, for the garden, on any farm. Horse and cow dung, fowl droppings,

dead leaves, and litter should be collected and well rotted in a heap, protected from rains if possible. When digging up the soil make it as fine as possible; if it is very stiff and hard collect all the ashes and burnt rubbish obtainable, and apply; or if lime is available a good dressing may prove to be very beneficial. Heavy dressings of dung, vegetable matter, &c., will, in time, make a hard, stiff, sticky soil friable and easy to work, but it must be well drained in the first instance.

A few flowers planted about the edge of the beds will add considerable interest to the work, for they need occupy but little space, and will assist to make a place homelike, cheerful, and comfortable.

When following the directions given considerable allowance must be made for differences in seasons in various parts of the Colony. A little judgment must be exercised, but experience will soon teach caution.

During the month of August preparations should be made for the planting and sowing of tender vegetables such as French beans, tomatoes, sweet potatoes, cucumbers, pumpkins, vegetable-marrows, squashes, capsicums, and others, especially in the warm districts near the coast where late frosts are not likely to occur. It is highly desirable to look ahead and be prepared for the most active planting season of the year. If the ground is quite ready, little time need be taken up with sowing and planting when the season comes round. The work of preparation to be done now is a thorough digging and manuring of the ground, and the sowing and planting of the following vegetables:—

Asparagus.—This excellent vegetable should be planted at once, if roots can be procured. Although it must occupy the ground for two or three years before the shoots will be fit to pull or break off, this should not prevent it being planted, for after it once begins to produce, it will keep on for years bearing heavy crops of most wholesome food, if a little care be taken to provide it with a sufficiency of manure from time to time. It will succeed admirably in many parts of the Colony, where, at present, it is not to be seen. Indeed it is difficult to say where it will not thrive.

Although not a deep rooting plant, the ground should be dug at least 18 inches deep. It prefers a rich, light, warm soil, but this is not absolutely necessary for the production of good shoots. A dressing of dung, say 3 or 4 inches, should be well mixed with the surface-soil to the depth of about 6 inches. When the ground is quite ready for planting, dig holes about 6 inches deep, and large enough for the roots to be spread out evenly without touching the sides. Fill in with fine soil by hand, and firm it well down, but take care not to break the fleshy roots. The crown of the plant should be about 2 inches below the surface when covered up. The plants should stand about from 2½ to 3 feet apart. A dozen or eighteen plants will give a fair supply of "grass" when they have become well established. If plants cannot be procured, the grower will be obliged to sow seeds and raise his own plants, and the work of sowing had better be done some time during September or early in October. Directions for sowing will be given next month.

Artichoke, Jerusalem.—If tubers can be obtained they should be planted as soon as possible. This is a useful, wholesome, and nutritious vegetable, easy to grow, and very productive when planted on good soil. It belongs to the same family of plants as the sunflower. The ground should be dug deep, drained, and well manured with rotten dung. Plant whole tubers in trenches made about 6 inches deep, 3 feet apart, and the tubers about 1 foot apart. When the artichokes have all been dropped in, cover up the trenches and tread the soil down lightly until the bed

is level. Keep free from weeds, and when the plants come up, use the hoe occasionally between the rows. The artichoke may be dug for use when the stems begin to wither.

Beans, French, or Kidney.—Sow a few rows in the warmest districts if it be thought all frosts are over. This vegetable is very tender, and will not stand against frost. It is an easy, productive vegetable to grow, and very wholesome. The ground should be well dug, and if the land is poor let it be well manured. Beans will grow all the better if lime can be applied to the soil. Manures containing chiefly nitrogen, such as sulphate of ammonia, should not be used, but those containing chiefly potash and superphosphate of lime may be used freely, in addition to stable manure. Sow the seed in rows about 2 feet 6 inches apart, or 3 feet if the soil is very rich. Make drills about 3 inches deep, drop in the seeds from 4 to 8 inches apart, and cover with fine soil. The best variety for general purposes is that known as the Canadian Wonder.

Beet, red.—This is an excellent vegetable to have for a change. The ground should be dug deep, but it should not be manured expressly for this crop. It would be the best plan to sow the seed on ground that had been used and manured for another vegetable. Sow the seed in drills 18 inches apart, and about 1 inch deep. After dropping in the seed along the drill cover by hand with fine soil, and press down firmly with the back of a spade.

Beet, silver.—This is grown for the leaves only, and is one of the most useful of vegetables. The ground should be well manured with rotten dung, which should be thoroughly dug in. Sow in the same way as directed for red beet.

Broccoli, Brussels sprouts, cabbage, cauliflower, and Savoy.—These vegetables belong to the same family, indeed, they originated from one plant, the wild cabbage; but by careful selection, and high cultivation the above well-known varieties have been established. Seed may be sown of these in small seed-beds. Make the soil fine, and keep the beds level. Sow in little drills about 2 inches, or so, apart. The Brussels sprouts, broccoli, cauliflower, and Savoy will succeed best, at the present season, in the coolest parts of the Colony. Where plants are available they may be planted from 2 to 3 feet apart on well-dug and well-manured ground. The richer the soil the wider apart. In order to produce good cabbages, cauliflowers, &c., the seedling plants should be lifted without injury from the seed-bed, and planted with care. It is the general practice to pull the seedlings from the seed-bed, make a hole with a dibber, and plant in a very rough way. But there is no occasion for this kind of work in a small garden, and the more care that is taken with young plants the better they will succeed, no matter what kind they may be.

Celery.—Sow some seed in a small seed-bed or in a box of good soil. Let the box be well drained with holes in the bottom to let surplus water away easily. Make little drills with your finger about half-an-inch deep, drop in the seed thinly and cover with fine soil. Do not let the soil become dry. Shade, if necessary, from the sun, but let the shading be very light, and remove it before the plants grow much, otherwise they will become weak and "drawn." When the plants have grown to the height of about 2 inches move them to a small bed, well prepared and the soil made fine, set them out about 3 inches apart, in order that they may grow and develop into strong, sturdy plants, when they may be transplanted into their permanent places. The celery is a plant that needs plenty of manure and good regular supplies of water. A bed should be prepared for the young plants as soon as possible. Further particulars will be given next month.

Carrot.—Seed may be sown largely on ground that should be prepared in the same way as that for red beet. Sow in rows about 1 foot apart. The seed, being provided with numbers of little hooks, get stuck together; therefore, before sowing, they had better be rubbed well with some sand, in order to separate them. Carrot seed takes a long time to come up, and unless the beds are kept well weeded the young plants are likely to become smothered. When old enough to handle, thin out well.

Leek.—A most useful, wholesome vegetable, well worth growing. It requires rich soil and an abundance of manure. Some seed may be sown in a small seed-bed, from which the plants may be transplanted when they have grown to about 6 or 8 inches in height. The seed should be covered very lightly—in fact, barely covered with fine soil.

Lettuce.—Sow a little seed in a seed-bed for planting out when the young lettuces are large enough to handle. Plants may be put out if they can be obtained. The roots should not be broken more than can be avoided. Manure the ground with well-rotted dung before planting. In warm districts it is sometimes advisable to sow lettuce seed where the plants are to stand and not transplant, for this prevents, to a considerable extent, the tendency of the lettuce to "bolt," or run to seed too quickly.

Melons, Cucumber.—Seed may be sown in warm spots where the young plants can be protected from frosts. When all danger of frost is over, the plants may be moved to their permanent places.

Onion.—Sow largely of this important and wholesome vegetable. The ground should be well drained, heavily manured, and the surface of the onion bed made as fine as possible. Sow the seed in drills about 12 or 15 inches apart, and be very careful to merely cover the seed with fine soil. On no account must weeds be allowed to grow, or else the seedling onions will soon be ruined. When the plants come up and are fairly strong thin out to 6 or 8 inches apart.

Parsnip.—Sow largely in drills as was directed for red beet. The ground should be deeply dug, but, as in the case of red beet, fresh manure should not be applied.

Peas.—Should be sown largely in well-prepared ground enriched with rotted dung. Avoid the use of manure containing a large proportion of nitrogen, such as sulphate of ammonia. If artificial manure has to be used, apply superphosphate of lime two parts and kainit one part, at the rate of about a large handful to the square yard. Fine bonedust is useful, and so also is lime, lime rubbish, and wood ashes. Sow in drills about 3 feet apart. Do not cover the seed with more than 3 inches of soil. The peas should not be sown closer together than 4 inches. As soon as the young peas come up, put in sticks along the rows to support the plants from trailing over the ground. Keep the ground between the rows frequently chipped with a hoe.

Potato.—Plant a few rows of one of the varieties of Kidney potato, or if none can be obtained try the Early Rose variety. Dig the ground well and deep, drain it well, and manure it heavily with dung, and if considered necessary supplement this with a little sulphate of ammonia and kainit, or potash manure. The rows should be 3 feet apart, and the potato sets should be planted 1 foot apart and about 5 or 6 inches deep in the soil. Use fair sized potatoes to plant whole, or they will probably succeed as well if cut in half. Let the cut side dry in the shade before planting.

Radish.—Sow a few short rows of seed in rich soil. Use well-rotted manure for this vegetable.

Rhubarb.—A most desirable plant to grow. It needs rich, well-drained soil heavily manured. If roots can be obtained they should be planted as soon as possible 3 or 4 feet apart, and the crown about 2 inches below the surface of the soil. Plants can easily be raised from seed, but the leaves will not be large enough to pull for some considerable time longer than from planted-out roots. Seed may be sown next month, when further particulars will be given.

Turnip.—Sow a little in drills about 1 foot or 15 inches apart. Cover the seed with not more than an inch of fine soil. The ground should be heavily manured with rotted stable dung, or superphosphate of lime, or fine bone-dust or lime.

Tomato.—Sow a little seed in a warm, sheltered place, and protect from chance frosts. In the warmest parts of the Colony seed may be sown in the open garden, or if plants have already been raised they may be planted out.

Pressure of time prevents more complete directions being written for the present issue, but in future more information will be given about the nature and habits of the different kinds of vegetable recommended for cultivation. In the meantime it is hoped some attention will be given to the important matter of setting aside a small area for vegetable growing by every farmer who reads the *Agricultural Gazette.*

Dairy Notes.

A REPORT has been prepared by the British Board of Agriculture, on the condition of dairy farming, and the development of the trade in dairy products in Denmark, Sweden, Germany (ex Bavaria), and Bavaria. Such a Report naturally conveys a large amount of valuable information, and it is therefore proposed to extract certain matters which appear to be of particular interest in regard to the present condition of the industry in New South Wales.

It seems that the immediate cause leading to the preparation of the Report in question was the large increase of butter into the United Kingdom from Northern Europe, imported during recent years. Within the last ten years the receipts of Danish butter in English ports have risen nearly threefold, or from 304,722 cwt. to 876,211 cwt., and those from Sweden in a still greater ratio, or from 67,821 cwt. to 234,987 cwt.

While these two countries must be considered the chief rivals of the Australian butter maker in the English market, it appears that great activity is at the present time manifesting itself in developing dairying in Schleswig Holstein. As all the countries named not only adopt the most modern and approved principles, their products commanding (those of Denmark in particular) high prices in the market, but investigation and experiment are continually being conducted, with a view to attaining still greater perfection, it behoves us on this side of the world to leave no stone unturned to maintain the high reputation which the best New South Wales butters have obtained in the English markets. This can only be done by adopting the most improved methods, and making sure that only the best and most suitable butter is shipped.

Turning to that portion of the report which refers to Denmark, considerable space is devoted to the treatment of cream intended to be made into butter. Thus it has been found that very appreciable differences might arise in the yield of butter if cream is not immediately cooled off to from 46°–56° F. after separation.

The production of a defined and uniform sourness in cream is another question, as to which the Report contains the following:—"Bacterial preparations for souring cream are said to be used with advantage in a few dairies, but they have not yet found general application in Denmark. M. Böggild (consulting dairy expert to the Royal Danish Agricultural Society) states that it is becoming more and more recognised that the quality of the butter depends largely on the souring of the cream. In those cases where the cream cannot be allowed to stand and get sour, the cream is soured by the addition of butter-milk, or cream reserved for that purpose from the previous day.

"A preparation known as 'new sour' is now largely used for souring the milk. It is generally made by exposing cream, half-skimmed milk, or new

milk, to such a degree of heat as is considered sufficient to develop the souring processes. M. Böggild urges the necessity of keeping the souring uniform from one day to another, otherwise the butter will vary on different days.

"Experience has shown that uniformity in quality seems to be best obtained by using as a souring medium the butter-milk produced in the dairy. The use of the 'new sour' is recommended in those instances where the quality of the butter is unsatisfactory, and especially where the milk comes to the dairy in various conditions as regards freshness, purity, and flavour."

It would appear from the following paragraph that it is not the practice to wash butter in Denmark. "It seems that it is not the practice in Denmark to wash the butter in the churn. The butter is either not washed at all or the strainer holding the mass taken from the churn is merely dipped into a tub containing water, which has been boiled and allowed to get cool, in such a way that a part of the water flows over the whole, thereby washing off the butter-milk which still clings to the small grains of butter. Many dairymen consider this latter system of washing the butter to be very effective in removing the butter-milk, and if carried out in a proper manner with water at a temperature equal to the churning temperature, it is, to some extent, to be recommended, although there is reason to suppose that in some cases it is detrimental to the *bouquet* of the butter, by carrying off the delicate aromas. In washing butter, Danish farmers are advised never to use water which has stood overnight in the cistern or reservoir of the dairy, and also not to throw water over the butter when passing the product through the 'worker.'"

On the subject of co-operative dairies the report says:—

"The development of the dairy industry in Denmark has been accompanied by a remarkable extension of the co-operative system. This system has been adopted to meet the want of organisation felt by the farmers, and has proved eminently successful as far as the dairies are concerned.

"It is estimated by M. Böggild that there are now about 1,000 co-operative dairies in existence throughout the country. In nearly all cases the farmers who produce the milk are also owners of the dairy buildings and plant. The milk is always paid for by weight and not by measure, but at many dairies, between 300 and 400, the price is also regulated by the percentage of fat in the milk.

"In the rules of most co-operative dairies, it is provided that the cows shall be milked dry, the hour also is sometimes fixed at which the milk for domestic use shall be taken, and in several instances members are not allowed to take any milk out of the churns after it has once been strained into these receptacles. The dairyman is advised always to be on the alert to discover any addition of water, or of skim milk, to the milk; but since the introduction of the system of paying for the milk according to its fat contents, there has been less necessity for vigilance in this direction."

The above should impress on co-operative dairies in this country the necessity for adopting the like system here. As has many times been pointed out in the *Gazette* the payment to a farmer of just what he is entitled to, no more and no less, is the very best lesson he can receive. In fact it is the only means of bringing the fact home to the dilatory or unscrupulous farmer that his tactics do not pay.

The educational, political, and commercial phases of the industry are also fully dealt with, and with regard to the first named it is evident that the Danish Government fully appreciate its importance. The following extracts clearly state the position:—

"It appears that in Denmark there are at present only three agricultural schools where instruction is provided in the theory of dairying and allied subjects. A large number of dairies, however, take in pupils, and train them in practical dairying. The good work being done by these schools and dairies is supplemented by lectures on the higher branches of dairy science at the Royal Veterinary and Agricultural College in Copenhagen.

"The Government exercises no control over the dairies, nor does it directly support the dairy schools, but indirectly it assists them in many ways. Besides offering bursaries and scholarships, the State makes a large grant annually to the Experimental Laboratory for Rural Economics, this institution being mainly occupied at present in arranging a series of butter shows in which more than 400 dairies take part. Other special grants are made in aid of experiments. The State has also appointed three consulting dairy experts in Denmark and one in England."

In future issues we propose continuing these notes and hope to deal fully with the question of butter shows and their objects and also to look shortly to the other countries embraced in the reports for valuable hints towards the improvement of our own export trade. In the meantime we desire to emphasise the fact that, as will be seen from the preceding extracts, every effort of the Danish dairy farmer is towards improvement. They are not yet satisfied even with their present pre-eminent position in the London market. Doubtless this state of affairs is influenced by the arrival and success of Australian butter, but it must always be borne in mind that Denmark is working on a longer experience and that there is no way but that of consistent improvement based on scientific discovery to even catch up with, much less to outstrip her.

General Notes.

National Prizes—Poultry Farms.

The competition for National Prizes amongst poultry farmers was this year robbed of a certain amount of interest in consequence of the withdrawal of three of the competitors, owing to floods and other causes. The judge, Mr. Albert Gale, has duly submitted his awards, which have been approved by the Minister for Mines and Agriculture, and the following have been successful:—

First prize, Ambrose Hallen, Toongabbie

Second prize, Messrs. E. P. Capper and Sons, West Maitland

Highly commended, Mr. J. J. McCue, "Moorside," Telegraph Point.

A Durable Whitewash for Farm Buildings.

We have tried the mixture as stated in our May issue, which was copied most carefully, and find it necessary to vary the directions in the following manner. Instead of half a bushel of unslaked lime as recommended, one bushel at least was found necessary, and again, although it may be advisable to add five gallons of water, it was found that when boiled up for use, after standing the required time, the mixture was far too thin, and did not show at all when laid on. Ultimately the whole of the clear water was taken off, and the sediment when heated formed an excellent whitewash of the consistency of paint, which will cling to perfectly smooth timber, and look very white and smooth. The cost of materials was about 4s. 6d. bought in the quantities stated, and sufficient was made to thoroughly cover the walls of a good sized four-roomed weatherboard cottage.

Dishorning.

The following method of dishorning, says the ***Australasian***, is recommended by Mr. Leslie H. Adams of the Wisconsin Experimental Station. The operation is performed on calves by means of an application of caustic potash which can be obtained in the form of sticks about the size of a lead pencil from almost any chemist. The recommendation is as follows: "The best time to kill the horn is when the calves are from three to six days old, or as soon as the little horn button can be definitely located. With a pair of scissors clip all the hair away from the embryo horn. Dip a finger in water, and moisten the horn, dry the fingers, and, after wrapping all but the lowest end of the stick of potash in paper, to prevent the fingers coming in contact with it, hold it as one would a pencil, and rub on the horn. All

portions of the horn must be treated. During the process of applying the potash the horn must be kept moistened; but great care should be observed not to put on so much water as to cause the dissolved potash to run down the calf's head, and cause unnecessary suffering. When the horn takes on an inflamed appearance, and the skin that covers it has become loosened, it will be evident that it has received sufficient treatment. This application, or indeed that of any other fluid prepared to accomplish the same purpose, does cause some pain, but it does not last so long, nor is it as severe as in the case of the mature animal when the saw is employed."

Draining Pipes.

Having found it necessary to obtain quotations for agricultural drain pipes, in order to supply the information to correspondents, we give them for the benefit of our readers. Messrs. Goodlet and Smith (Limited), of 493, George-street, Sydney, quote as follows:—

1½	inch,	40s.	per	1,000	Less 20 % discount
2	"	60s.	"	"	
3	"	100s.	"	"	
4	"	15s.	"	100	
6	"	25s.	"	"	

in railway trucks, carriage paid to Darling Harbour railway station.

Treatment of Diseases.

A line of treatment for apple-scab is recommended in the *California Fruit-grower* of 11th March, the following "conclusions" being those of Professor S. A. Beach, of the Geneva, New York, Experiment Station:—

"In the light of our present knowledge of the nature of the apple-scab fungus, and guided by personal experiments and those of other investigators, the following line of treatment is suggested:—

"After the buds open, and before the first leaves are half-grown, make the first application, using either the ammoniacal solution of copper carbonate or dilute Bordeaux mixture. Mr. G. D. Fairchild found, last spring, that the pear-scab infection begins before the blossoms open, and the writer found that the same thing occurs also with apple-scab. The foliage and the calyx and pedicels of the unopened flower-buds become thus early infected with the scab fungus. Spraying at this time is therefore considered very important. The second application, using the same fungicide as before, should be made after an interval of ten days, and shortly before the flowers begin to open. The third application should be made immediately after the blossoms fall, using also at the same time Paris Green or London Purple for codling moth. Many prefer to use the dilute Bordeaux Mixture at this time, because Paris Green can be added to it without fear of injurious results, whereas if the ammoniacal solution of copper carbonate be used, the Paris Green must be used by itself. A fourth application should be made after an interval of ten days or two weeks, using the same material as before, including the Paris Green.

"After another interval of ten days or two weeks make a fifth application, using the same material as before, including the Paris Green. If it is desired to make further treatments after this time, the Paris Green may be omitted."

Successful Treatment.

The following reports have been received of the successful treatment of various diseases as recomended by the Department, and are reproduced solely with a view to inducing other orchardists to follow suit;—

Mr. J. D. Robertson, of Bowning, writes: I have followed advice offered in the *Gazette* on spraying with Paris Green for codlin moth with considerable success; also spraying with Bordeaux Mixture for apple-scab very successful.

Mr. W. J. Washer, Maguria, Cootamundra, writes: I here give you the details of my experience this past season with spraying vines, &c. I may state that the two seasons previous to last a plot of grape vines of 1¼ acres in extent, in full bearing, was badly affected with anthracnose; one season to the extent of 90 per cent., and the other season about 50 per cent. of the grapes were destroyed or rendered unfit for sale. This induced me to purchase two of the machines described in the *Agricultural Gazette*, vol. II, part 10, as the Vermorel spraying and sulphuring machines, and I fully endorse all that is there said of them. All through the winter of 1892, and up to November, the season here was wet and cold, the ground being boggy. As a consequence, anthracnose put in an appearance soon after the buds of the vines burst open, and as I was watching for its appearance, I at once began operations and sprayed them with Bordeaux Mixture as advised by you. It checked the disease immediately. I still watched, and after an interval of three weeks I found it necessary to repeat the spraying, and again just when the vines were on the point of blossoming. I did not find it necessary to use any more spray. I sulphured each time between the sprayings, lightly. The cost of the materials used was as follows:—

	s.	d.
Sulphate of copper (bluestone), 6s.; lime 6d.	6	6
Flowers of sulphur	10	0
	16	6

The labour of mixing, spraying, and sulphuring combined would not amount to more than one day's work, and if the materials were purchased wholesale, and a larger area treated, the cost would be considerably below £1 per acre. The vines treated were free from disease, the bunches larger than they have ever been before, with no refuse of any sort. I can freely say that the spraying saved the greater quantity of my grapes. . . . . . One other success I had with spraying a plum-tree. It was badly affected with aphis (black and green) and a small green slug. I used the resin and soda wash as advised by you, and I had not to repeat the first spraying."

M. Edwin S. Rush, Willow Vale, Mittagong, reports the successful result of using equal parts of sulphur, pig's lard, yellow clay, and fresh pig manure for plastering on trees which had been completely deprived of bark 1 foot to 2 feet up the stem by hares. The trees, he states, were completely cured, and have since borne fruit of good quality.

Mr. J. G. Piggott, of Bundarra, reports that he acted on the advice of the fruit expert, and pared away the bark of some of his cherry-trees which were gumming badly, and found the remedy completely successful, stopping the gumming at once without the loss of a limb.

Loss of Bees by Drowning.

A communication from Mr. L. F. Woolrych, of Bee Hill, refers, amongst other matters, to the loss he experienced last year in consequence of his bees getting drowned when visiting the tanks for the purpose of drinking. The

loss became so serious that he tried a number of means for preventing it. Floating wood, &c., was of no avail, so he mentioned his difficulty to Mr. Charles Moore, Curator of the Botanic Gardens. Mr. Moore supplied him with *Nymphœa lutea* and *N. alba* which have grown well and have more than answered their purpose. The bees may now be seen alighting on the leaves to drink, and not one dead bee is to be seen in the water. There has not yet been sufficient time to ascertain whether they are partial to the flowers, but in any case the experience is worth the attention of other bee-keepers who may have been losers under similar circumstances.

The White-throated Nightjar.

In March last a letter appeared in the *Sydney Morning Herald* over the signature "Richard Edward Nancarrow" calling attention to a bird which had recently made its appearance in the orchards at Lane Cove. Mr. Nancarrow was good enough to forward a specimen to the Department which he described as a species of Moth Hawk, and mentioned that it could be seen about twilight flitting about the trees devouring all kinds of insects. That Mr. Nancarrow is correct in his statement of its habits is evident from the particulars given of this bird, which has been identified as the White-throated Nightjar, in Gould's *Birds of Australia*, where they are described as being "gorged with insects, principally Coleoptera (beetles) and locusts." That it also devours the codling moth is questionable owing to the small size both of the moth and the larva, and the latter stage would be more likely to attract the bird. The fact that it can swallow locusts and that they can be removed from its body in a sufficiently perfect state for preservation in a cabinet would imply a preference for larger kinds of insects than the codling moth. His suggestion that the White-throated Nightjar should be included in the list of protected birds under the Game Act, in order to prevent reckless destruction by thoughtless people with guns, would appear worthy of consideration as there is no doubt of its utility to the orchardist.

With a view to assisting orchardists and others in identifying the bird we append the following notes which have been kindly supplied to the Department by Mr. Alfred J. North, F.L.S., of the Australian Museum:—

"The White-throated Nightjar, *Eurostopodus albigularis* of Vigors and Horsfield, belongs to the family *Caprimulgidiæ* of the order *Picariæ*, and is in no way allied to the *Accipitres* or birds of prey as referred to by your correspondent. It is considered rather a rare bird in the neighbourhood of Sydney, only two specimens being acquired by the Trustees of the Australian Museum during a period of seven years, one being shot at Botany, the other at North Shore, and it is by no means common in any portion of the Colony. In form it approaches near to the well-known Tawny-shouldered Podargus, *Podargus strigoides* of Latham, to the latter of which is frequently applied the erroneous name of "More Pork" by the residents of New South Wales, but it is less robust, more elongated and considerably smaller in size. The plumage is moth-like in its markings especially on the scapularies, and being soft and downy, is well adapted for noiseless flight. The mouth is disproportionately large for the size of the bird, but well suited for capturing its prey, and is covered almost to the tip of the bill with very fine hairs, the bill being weak and flexible, and fitted only for procuring insects which constitute its sole food. The most conspicuous markings of this bird are the large oval spots of white on each side of the throat which stand out in bold relief against the blackish-brown tints of the centre of the throat and the chest.

For the purpose of breeding, this bird deposits a single egg on the bare ground which, however, is well protected by its environment closely assimilating to the colour and markings of the egg, as well as the parent bird itself when engaged in the duties of incubation, the site usually selected being on the side of a gravelly ridge, or near some stump or stone in open forest lands. The egg is elliptical in form, and of a rich cream colour, marked with rounded or oval spots, and dots of inky-black sparingly scattered over the surface of the shell; it measures 1·55 of an inch in length by 1 inch in breadth.

This bird rears but two young ones during the breeding-season, which lasts from August till the end of December, and being strictly insectivorous should be zealously protected both by the orchardists and farmers."

A Private Experimental Farm.

A report by Mr. E. de P. O'Kelly, late Departmental Inspector for the North Coast, contains a quantity of interesting matter resulting from a visit which he paid recently to Mr. E. Seccombe's Experimental Farm at Wollongbar. This farm is situated on the Ballina Road, distant about 8 miles from Lismore, and is divided into two portions, about 2 acres being devoted to growing new plants, and the remainder laid out in pasture paddocks, a matter which Mr. Seccombe has made a speciality. The soil is a volcanic, loose, red loam, with a good depth of humus.

With regard to the grasses, the endeavour of Mr. Seccombe is to introduce such new ones as are likely to prove suited to the conditions of soil and climate, and to foster such local grasses as are of known value. In regard to this work, he has been in constant communication with the Department, and is growing, with considerable success, several species, amongst which may be mentioned cocksfoot, Poverty Bay rye grass, Kentucky blue grass (*Poa pratensis*), and several others of the *Poas*, *Paspalum dilatatum*, &c.

Coming to the new plants of commercial value, rice is the first dealt with, and the following particulars were supplied by Mr. Seccombe with regard to the variety known as *Kyba Sava*, the seeds of which were supplied by the Department. The seed was sown broadcast over a ground surface of 102 yards, or 1–47th of an acre. It was planted on the 29th October, 1892; germinated on November 4th; flowered February 16th, 1893; harvested March 26th, 1893; and yielded 56 lb. clean seed, equal to 47 bushels or 2,632 lb. per acre. This rice grew vigorously during the whole period of ground occupancy, and was not affected by either blights, fungus, or insect pests. It attained a height of 4 feet at flowering time. A material loss of seed occurred through continuous wet and the rice falling. Mice also cut off a great deal of that lying down. The crop can be readily harvested with the hook without necessitating a great reduction of green feed, which latter forms one of the principal factors in favour of rice cultivation. Rice straw of this description is succulent, being green and fresh at harvesting period, therein differing from wheat, oats, and barley when cut at maturity. Stock consume it readily, while horses eat it to the last straw supplied. Rice must be harvested immediately it arrives at a general state of maturity, otherwise the loss would heavy. Fully-ripe rice drops with any unusual force, be it wind or rain, or the hand of the harvester. The average weight of fodder in this instance, after the seed was gathered, would be from 25 to 32 tons per acre, and it is believed that this cattle food would not deteriorate in quality or quantity if permitted to stand undisturbed even for a considerable time. It can therefore

be utilised by cutting out and hand-feeding at the convenience of the producer. With regard to the grain itself it was described by Mr. O'Kelly to be a fair sample, though small and not very well filled out, but these are points where improvement may be confidently looked for as time familiarises it with the soil and climate of our North Coast districts.

Madagascar Rice.—This variety was planted broadcast on the 28th November, 1892, and at the date of Mr. O'Kelly's visit (17th May last), was over 4 feet high, and just coming into seed. The seed heads, however, are nearly all without grain; but this is a matter which will improve by more complete acclimatisation. Ths straw of this rice is very large, the leaves are about ¾-inch broad, and the growth would yield about 40 tons of fodder to the acre. The *Double Coarse Rice* planted 8th November, 1892, and *No.* 1 *Patna*, planted 29th October, 1892, although growing well, showed no sign of seeding, and did not appear likely to do so. It was Mr. Seccombe's intention to utilise them for fodder.

Amongst other plants cultivated were 150 Australian nut trees (seedlings). This plant was figured and described in Vol. IV., page 3, as a New Commercial crop. There was also an excellent crop of arrowroot, which was estimated to produce tubers at the rate of 50 to 60 tons to the acre.

Pea-nuts.—This crop does very well in the locality, giving a yield estimated at over 2 tons to the acre. The plant and fruits were figured and described in Vol. II., page 5, and the result of this experiment by Mr. Seccombe should convince farmers on the northern rivers of its suitability as a commercial crop.

There are numerous other crops embraced in Mr. Seccombe's collection as to which it will be sufficient to mention that they include coffee, jack fruit, tea, papaws, dates, lee chee, and chocho, all of which appear to flourish.

Lemons for the United States.

In connection with the curing of lemons advocated in the *Gazette*, Vol. III., page 666, it is worthy of note that there is a large market open in the United States for this fruit. According to the Citrus Fair edition of the *California Fruitgrower*, the import of lemons into America is steadily increasing, the value rising from 2,510,426 dollars (£502,085) in the year 1885, to 4,831,334 dollars (£966,267) in the year 1892. As in the case of all other outside markets, it is useless sending any but first-class well-cured fruit, and moreover, grading and careful packing will be important elements in ensuring success.

Distribution of Rust-resisting Seed-wheats—Season, 1893.

No. of applications received	451
Quantity of wheat obtained	61 bus.
No. of packets distributed	2,763

These wheats were all grown (with the exception of 1 bus.) in the Colony, by farmers who had been supplied with seed the previous season, and these gentlemen must be congratulated on the great improvement in the samples, the grain being much plumper and far cleaner than the seed supplied to them. A number of the varieties were sent out in 2½-lb. samples, and the remainder in quantities of from ½ lb. to 1 oz. The applications for these

wheats were far more numerous than was expected (showing the great interest taken in these experiments), and as a consequence the packets had to be reduced, whilst some of the late applications could not be complied with. The following is a list of the varieties sent out:—

Australian Glory
Australian Wonder
Amethyst
Allora Spring
Algerian
Bega
Belatourka
Bird-proof
Blount's Lambrigg
Blount's Fife
Broderick's
Brisbane
Cook's
Early Para
Egyptian Mummy
Farmer's Friend
Fillbag
Fluorspar
Flourball
Fountain
Frampton
Fultz
Galland's Hybrid
Goldsmith's Pedigree
Hornblende
Hundredfold
Improved Fife
Jacinth
Jordan's
King's Jubilee
Manitoba
Médéah
Niagara
Pride of the Market
Prince of Wales
Pringle's Defiance
Quartz
Rattling Tom
Red Californian
Saxon Fife
Smith's Nonpariel
Square-headed Sicilian
Stand-up
Steinwedel
Summer Club
Talavera
Thomas' Rust-proof
Tourmaline
Vermont
Victorian Defiance
Ward's Prolific
Ward's Prolific, Marshall's White
White Fife
58 A

AGRICULTURAL SOCIETIES' SHOWS, 1893.

Society.	Secretary.	Date of Show.
Urana P. and A. Society	E. C. Lukey P. R. Brett	July 12, 13
Warren P. and A. Society	F. C. Thompson	July 18, 19
Deniliquin P. and A. Society	H. J. Wooldridge	July 20, 21
Riverina P. and A. Society (Jerilderie)	M. Curtin ...	July 25, 26
Gwydir P. and A. Society (Moree)	S. G. Cohen ..	July 25, 26
*Hay P. Association...	T. W. Blanche..	July 26, 27
Condobolin P. and A. Association...	A. James ...	Aug. 1, 2
Corowa P., A., and H. Society	A. A. Piggin ...	Aug. 2, 3
Narrandera P. and A. Association	J. F. Willans ...	Aug. 2, 3
Forbes P., A., and H. Association	W. G. Dowling..	Aug. 10, 11
Grenfell A. and H. Society...	G. Cousins ...	Aug. 16, 17
Horticultural Society of N. S. Wales	E. S. Sawtelle...	Aug. 23, 24
Northern Agricultural Association (Singleton)	C. Poppenhagen	Aug. 23, 24
Burrangong P. and A. Association	C. Wright ...	Aug. 24, 25
Cootamundra A., P., H., and I. Association	T. Williams ...	Aug. 30, 31
*Moama A. and P. Association	C. L. Blair ...	Sept. 5, 6
*Murrumbidgee P. and A. Association (Wagga) ...	H. T. Davidson	Sept. 6, 7
Albury and Border P., A., and H. Society	G. E. Mackay...	Sept. 13, 14
Burrowa P., A., and H. Association	J. H. Clifton ...	Sept. 14, 15
Junee P., A., and I. Association	M. H. Davis ...	Sept. 20, 21
Yass P. and A. Society	B. A. Nicholls...	Sept. 20, 21
Germanton P. and A. Society	G. V. Rahn ...	Sept. 20, 21
Upper Manning A. and H. Association (Wingham). (Spring Flower Show)	P. Doust ...	Oct. 24.

* These Societies get District National Prizes.

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CONTENTS.

Vol. IV, Part 12. *DECEMBER.*

Hemp:

Commonly known as Russian or Italian Hemp.

By J. H. MAIDEN,
Consulting Botanist.

Introductory.

Inquiries have been made at the department in regard to the cultivation of hemp, and the following notes are offered in response to such inquiries :—Hemp can readily be grown in many places in the coast and mountain districts of this Colony, but when the difficulty of producing really good hemp-plants has been surmounted, there remains the important matter of the extraction and preparation of the fibre for market. This is hardly less important than the cultivation. There are numbers of persons practically engaged in the fibre industry in these colonies who will willingly furnish the required information, or, if any number of people take the matter up in earnest, the department will use its influence to obtain the most reliable information on the subject. This preparation has proved a source of difficulty with many people, and must not be lost sight of.

Just another word of caution. An English writer points out that only particular circumstances render hemp a desirable culture in England, for it cannot be considered a productive crop, as it requires much manure, and another writer says, "Hemp land will grow other crops of equal or superior value at a less cost." This is not entirely true, even in England, as hemp cultivation is profitable in certain counties. But whether and where it will prove to be a profitable crop in New South Wales, and to what extent, can only be satisfactorily proved by actual experiment. At the same time, hemp is not the article of national importance it was in the days when it required nearly 200,000 lb. of it to completely rig a first-rate ship of war.

Hemp is sometimes used to destroy weeds, choking and smothering them as a rule, but it must be borne in mind that it impoverishes the ground. It has long been asserted that when sown near any valuable crop which is subject to the ravages of grubs and caterpillars, it completely banishes them. The method among the old gardeners was to sow a belt of hemp round their gardens or particular beds, to preserve them from the depredations of insects. An advantage of hemp is that it yields a return within one season.

Hemp is expensive, and is consequently not much used at present by our local rope-makers, who chiefly consume Manilla hemp, a product we cannot hope to grow, and New Zealand flax, an article in which we cannot compete with the sister Colony.

A

The Plant.

Habitat.—Hemp is supposed to be a native of North India, Turkestan, and Persia, and perhaps other countries, but it has been long cultivated in Europe. It grows in most parts of India, and on the Himalayas to an elevation of 10,000 feet, but succeeds better at an elevation of 5,000 or 6,000 feet. It is found in Japan, China, Persia, Egypt, and North Africa, Spain, Servia, Russia, Poland, and Italy, the three last countries producing the best fibre. It also grows in France, Holland, Sweden, and England, in the latter country chiefly in Yorkshire, Suffolk, Lincoln, and Somerset. It is also grown in Ireland, in the United States, and to a less extent in Cape Colony and Victoria. In fact, there are few countries with temperate climates in which it has not been more or less grown.

General Description.—Hemp is what is known as a diœcious plant—that is to say, the female flowers are borne on one plant, and the male flowers on another. It is an annual, growing to a height of from 4 to 10 feet, and on rich soil to double that height. The male plants differ from the female in being more slender and delicate, and rather taller; the fibre is finer, and the flowers grow in clusters of nine or ten at the crown of the stem. The female plants have tufts of leaves at the extremity of the stem, the seed growing on the stem. The growth of the male plant is faster than that of the female. The stem is grooved or angular, and consists of a soft pith, surrounded by a layer of loose, woody, and cellular tissue, and enclosed in a thin bark containing the fibre, which renders the plant so valuable. Its botanical name is *Cannabis sativa*, and it belongs to the natural order Cannabinaceæ. The word *Cannabis* is from an Arabic root; *sativa* is from the Latin, and signifies "that which is sown or planted."

Synonym—Cannabis indica, Lamk.—For some time the European form of the plant was supposed to be distinct from the Asiatic, the chief value of the latter consisting in its narcotic properties, but this distinction has now disappeared, since it could not be supported by botanical characters.

Culture.

If a grain of hemp-seed be sown by itself in suitable soil, it forms a thick, firm stem, and has many branches, being even umbrageous; the bark, however, is too coarse for the extraction of fibre. On the contrary, where the seeds are thickly sown, and the plants grow close to each other, lateral branches are not formed to any extent, the plant is straighter and less coarse, and the rind or bark of the plant is valuable for the fine, soft fibre contained in it. Care must, however, be taken not to sow the seed too thick, otherwise the plants will choke one another. It will be necessary to observe a medium course, which can be readily ascertained in practice.

Soil.—A rich, moist soil suits it best, especially beds of alluvial deposit. Stiff clay is bad; friable loams containing much vegetable matter are well suited to it. Over-rich soils produce coarse but strong fibre;. light, poor soils, when well manured, will bear the crops for several years in succession. The finest quality of fibre is obtained on soils of medium richness. The best hemp in the world is grown in the Romagna of Italy, on rich, strong loams, made fine and friable, and well manured. Mr. Rowlandson says the best land for obtaining fibre of the strongest description is a fat loam, not too heavy with clay, and a portion of sand intermixed. On such land, succeeding a crop of beans, hemp will grow 6 or 7 feet high, and the bean stalks make good manure for hemp. He adds: "I have known 9 quarters of beans per

acre after hemp, weighing 21 stone per sack. Hemp after beans will produce 30 stone more per acre, of the strongest and heaviest fibre, than by any other mode of culture; the weight of fibre in ordinary culture and circumstances will produce 60 to 70 stone per acre" (*op. cit.*) A good crop of hemp after beans will produce 28 to 30 bushels of seed per acre; in the ordinary way, 20 to 22 bushels per acre.

New South Wales localities for Hemp.—Dr. Campbell records the following to show the suitability of some Sydney soil for hemp cultivation. He sowed some on the 18th December; the plants came up thickly on Christmas morning. The ground was a patch of rather light clayey loam, which had received a slight dressing of manure, and had borne a crop of potatoes the year before. The ground was dirty and overrun with weeds, and all the preparation it received was breaking up with a heavy farm hoe, and smoothing with a rake. The plants grew at the average rate of 2¾ inches per day every day since they were about a foot high. They of course sprang up more readily after rain than in dry weather. For the first six weeks after sowing they had to contend with a prolonged drought. Then the tallest plants were beaten down by large hail-stones. Those which escaped this calamity were fully 2 feet shorter than the others, yet their height on the 3rd March was 8 feet. Speaking of New South Wales localities for hemp culture, Dr. Campbell stated: "Of those districts of the country which I know, I shall only enumerate the alluvial tracts, and the drained swampy lands in the districts of the Hunter, the Wollombi, the Williams, and the Paterson Rivers; the aquatic meadows of the Parramatta River, where they have been drained, the low flat lands of the Hawkesbury, the Nepean, and the fine, rich loams of the Shoalhaven. To these may be added the elevated and dried beds of former lagoons, and the basins of lakes, which have been filled up to the general level by the detritus of mountains and decayed organic matters on the surface of the circumjacent grounds, which are washed down in rainy seasons." There is much land of the kind indicated in the southern half of the Colony, and, even at the expense of a little repetition, it may be stated that, given good soil, the crop requires plenty of moisture; also, since it is intolerant of frost, in districts liable to frost, the seed must not be sown until all danger on this score is over. On the other hand, hemp deteriorates in too warm a climate, forming a narcotic resinous exudation at the expense of the fibre, so that it is not to be strongly recommended for the northern rivers, at all events until its cultivation has been thoroughly tested in the southern parts of the Colony.

Cultivation, Seed, &c.—The land must be well ploughed and drained, harrowed and rolled, and cleansed from all weeds. The quantity of manure necessary will depend on the richness and warmth of the soil and upon the climate. In England 10-25 tons rotten dung to the acre is not considered too much; warm, moist climates require much less. The ash of the plant contains 42·05 per cent. of lime, 7·48 of potash, and 3·22 of phosphoric acid. Provided lime in some form be supplied to the soil, the crop should be much less exhausting than flax. Sir Joseph Banks stated that the Italians (who produce the best hemp in the world), have a saying "Hemp may be grown everywhere, but it cannot be produced fit for use without manure." All authorities join in saying that it is useless to attempt the cultivation without manure, but the quantity required in different situations cannot always be expressed in a general statement. Hemp land may be over-manured, and a coarse fibre be the result. Constant changes of seed are always beneficial. The seeds should be plump, and of a bright gray colour; they must not have

been heated in any way, and should, therefore, have a sweet flavour. The quantity required is about 3 bushels to the acre. Sowing in drills produces coarse, strong fibre, fit for cordage; broadcast sowing is preferred when the fibre is to be used for textile purposes. Birds are fond of the seed, and often cause the cultivator a good deal of anxiety for this reason, until the plants are well up. It is, however, to be noted that hemp-seed is one of the readiest of seeds to germinate when perfectly fresh. The seed must not be buried, but only just covered in the ground with mould as fine as it can possibly be made by repeated harrowing. As hemp-seed is hardly concealed in the ground, like other seeds, it is readily seen by birds, who may very easily pick it all up. If, however, this danger can be overcome by constant watching for a week or two, the plant requires no further attention until harvest. As soon as the young plants appear, the ground is thoroughly weeded and the plants are thinned out, according to the class of fibre required and the capability of the ground. A second weeding is sometimes needed, but generally the plants grow so rapidly as to keep down weeds. Abundant moisture is requisite during growth, hence irrigation is practised in some localities. Dry lands are not fit for hemp; it does not rise well in them, but remains short and stinted in its growth, and its fibres are then generally too woody, which renders them hard and elastic—both considerable defects.

Harvesting.

Pulling.—As the fibre afforded by the male plants is tougher and better than that yielded by the females, it is usual to divide the harvest. The males are gathered as soon as they have shed their pollen (in other words, as soon as they have done flowering), about thirteen weeks (in England) after the sowing; they are then recognised by their leaves being yellow, stems whitish, and flowers faded. Each is uprooted singly, care being taken not to injure the stem. The ripening of the females, which occurs about a month later, is indicated by similar signs, as well as by the grey tint of the seeds, and the opening of the capsules, showing that the seeds are just ripe. If the plants are left for the seed to ripen thoroughly, the fibre becomes coarse and woody, and difficult of extraction; hence the full maturity of the seed should not be awaited. Plants which are to give sowing seed must have room to spread, and be left to ripen their seed. When it is not intended to preserve the seed, and when the fibre alone is utilized, the plants may be pulled when in flower, and without any regard to sex. As soon as the plants are pulled, they are held by the root, and carefully shorn of leaves and flowers, which help to manure the land.

Stooking.—When the stems are stripped, they are bound in small bundles, and the now dry soil adhering to the roots is knocked off. The stalks forming each bundle should be as nearly as possible of equal length, and the roots should be placed evenly. The bundles are then set on end in stooks like corn. If the crop is to be kept long, the bundles are made of larger size, and are stacked and thatched.

Gathering Seed.—The female plants, after gathering, are allowed to stand in the air for eight to ten days, to allow the seed to dry and ripen; the heads are then cut off, and the seed is threshed out. Bundles of seeded stems are best conveyed by a rope fastened round under the heads, and suspended over the shoulder. The seed remaining after threshing is combed out, but it is inferior, and unfit for sowing. The female plants are generally stacked during the winter, and not retted till the spring.

Drying.—The length of time for which the pulled plants should remain in stooks to dry before retting is a much debated point. Some authorities declare that one to two days' sun-drying is essential, while others state that it is unnecessary, and that ripe plants should be retted the moment they are pulled, the retting being then reduced from eight days to four. The time must, moreover, depend a good deal on the temperature of the water.

Extraction and preparation of the Fibre.

Retting.—The term "retting" is applied to a modified process of fermentation, or rotting, to which the stalks are subjected, with the object of loosening the fibres and facilitating their abstraction from the bark. The process is adopted with some other exogenous fibres, *e.g.*, flax. Some cultivators dry their hemp and sell it without retting, the purchaser retting it by steam.

1. *Water-retting.*—Watering or steeping is often conducted in mere ditches, 3 to 4 feet deep, and of varying length and breadth, dug on the margins of rivers. The bundles of hemp are laid at the bottom, covered with straw or sods, and weighed down by logs and stones. Putrid standing water makes softer fibres than running water, but the former engenders a disagreeable colour, which, however, is destroyed by bleaching. In some districts retting is carried on in basins of different altitudes, a small stream constantly trickling from one to another. The degree of retting greatly influences the strength and suppleness of the fibre; hence that intended for making fine textiles should be retted more than that for coarser goods, while fibre for cordage purposes should be retted least of all. The progress of the operation is readily ascertained by taking out a stem by the root end, and drawing the thumb-nail along it to the top; when the fibre slips up the stem the process has been carried sufficiently far.

2. *Dew-retting*—Is thus conducted:—The pulled stems are allowed to stand in the stooks for two to three days, and are then spread out carefully on the grass. Here they are subjected to the effect of showers and dews, and an occasional watering if necessary, for a period which may extend to six weeks, care being taken to turn them constantly during the whole time. The appearance of pink spots on the stems must be watched for, whereupon the stems must be gathered up, tied in bundles, and piled in stooks to dry. By this method the most valuable white hemp is produced; but the operation is very tedious, and entails great expenditure for labour.

Drying after Watering.—After water-retting, the hemp is removed from the water to a field of grass, which is clean and unused by cattle. There it is spread out evenly, and allowed to lie for three weeks or more to bleach, and enable the fibre to free itself; during this time it is turned over with long light poles every three or four days. The process is considered complete when pink spots commence to appear on the stems. Drying is sometimes effected by exposure on walls or rocky ground, sometimes artificially in ovens. When dry, the stems are again tied up in bundles and carried to a barn or rick.

Breaking and Scutching.—So close a resemblance exists between hemp and flax stems that the machinery devised for the treatment of the latter is equally applicable to the former, always allowing sufficient strength to overcome the superior toughness of the hemp stems. The further preparation of the fibre will be described later on, if desired, as already stated.

Products other than Fibre.

Exudation.—In hot, dry climates, the fibre produced by the hemp-plant is of an inferior character, but the plant is cultivated for the sake of a resinous exudation which is produced by it. The resin is known as Churras in India, while the young tops and unfertilised female flowers, matted with resin, are known as Gunjah. Bhang consists of the older leaves and fruit-vessels. The plant is a narcotic employed by many millions of people in Asia (chiefly India) and East Africa, and is, therefore, a substance of great economic importance, but I do not propose to deal with the subject at length in this paper.

The Seed.—Hemp-seed is so well known that description of it is superfluous. Apart from its use for sowing, it is used for feeding birds, and for oil. Hemp-seed when good is firm, and will not readily break on being rubbed. The farmer should take care that it is always of the growth of the preceding year, as it soon loses its vegetative power.

The Oil.—The seeds contain about 30 per cent. of a pale limpid oil. The oil is at first greenish or brownish yellow, but the colour deepens when it is exposed to the air. The flavour is disagreeable, but the odour is mild. It is, however, said to make a very bad smelling and deep-coloured boiled oil, and on this account it is never used in England, although extensively so in east and north Europe as a paint and varnish oil. In Russia it serves, in a great measure, the purpose of lamp-oil, but it is chiefly employed in the manufacture of soft soaps, inferior to that from linseed oil. It has a specific gravity of ·9252 at 15° C.; it thickens at —15° C., and solidifies at —25° C. to —27·7° C. It dissolves in boiling hot water, and in 30 parts of cold alcohol.

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APPENDIX.

One of the results of the excitement caused by the high prices of binding-twine, a year or so ago, has been to bring into greater prominence the cultivation of the common or American hemp. Until recently the great bulk of this fibre produced at home was grown in Kentucky. Of late years, however, its cultivation has been extended in States north of the Ohio River, and during the past two seasons it has been grown to a considerable extent in New York, Illinois, and Missouri, while Minnesota and a few other States have contributed small areas.

As the aim has been, chiefly, to produce a grade of fibre that could be sold at a low price, for such coarse uses as binding-twine and the cheaper wrapping-twines, much of the labour attending the culture has been accomplished by machinery, and with the agricultural implements found on almost every farm in the West. The plan in vogue in Illinois, as reported to the Department by Mr. John Heaney, of Buckley, is to sow the seed as early as possible after the ground is in condition, March 25th being named for the season of 1889. The land is ploughed in the fall, if possible, and in spring the large disc harrow is used, followed by the smoothing-harrow. The seed is put in with a broadcast seeder, and afterwards carefully harrowed. When the crop is ready to harvest it is cut with mowers, and spread evenly, that the retting may be accomplished without the labour of turning over. If rainy, however, the Bullard hay-tedder is used to change the position of the straw or stalks, and to expose to the air the inside of any bunches that might be left to the action of the rains.

When retted, the stalks are raked up with a horse-rake, and loaded upon the waggons to transport to the breaker. Mr. Heaney says that 8 to 10 tons of straw per day can be taken care of. The fibre is not kept in a straight form, as the twine-makers break it up on the cards, and this form of fibre suits them better. Here are some of Mr. Heaney's facts, furnished the Department early in 1890 :—

"I can furnish the clean fibre at 4 cents per pound at a profit. I have 800 acres of hemp this year betwixt this place and Peotone, Illinois. I have shipped already 60 tons of fibre to the spinning-mill this fall and winter, from Buckley. I have one field of 140 acres from which I am expecting to get 1,500 lb. of fibre to the acre. It usually costs 15 dollars per acre for rent and labour—on the product of an acre delivered on board cars. If the people would but take 3,000,000 acres of land out of the corn and oats and wheat culture, and grow hemp, we could then consume all our grain at home, and save the millions we annually pay out for fibres. It would relieve the present agricultural depression wonderfully. All this fine country can raise hemp wherever it can raise a good crop of anything else."

Notwithstanding that the aim is to produce a cheap fibre, it must be admitted that this is a careless kind of cultivation, which may not always give satisfactory results. In a communication from another source, the danger of over-retting is referred to, and the statement made that in practice a difference of 50 per cent. is found to exist between well-saved and badly-saved hemp on the same ground.

In New York State, where for two years past hemp has been grown in the neighbourhood of Troy and Schaghticoke, for the Cable Flax Mills, a considerable quantity of good fibre was produced. I am informed by Mr. Hartshorn, of the Cable Mills, that the crop of the present season did not turn out well, although in 1889 the farmers engaged in the enterprise made money from hemp-culture.

Referring to the figures of production, the best record of income from the sale of a crop, net proceeds per acre, cost of seed deducted, was 76·48 dollars; the second best was 58·38 dollars; and the best five crops averaged 49·71 dollars per acre, exclusive of cost of seed. The total average of twenty crops—that is, the crops on twenty farms, including one complete failure and another crop which was almost a total failure from the drowning out of the plants when they were 18 inches high—was 18·22 dollars per acre. Sandy or loamy soils are considered most favourable, the hemp succeeding both on the "uplands" and in the "bottoms." The soil is ploughed very deeply, and made very mellow by the use of the harrow. Barnyard manures or standard fertilisers are used, as the soil must be put in good fertility to produce a successful crop. The seed is sown from 20th April* to 10th May, and the crop is usually harvested between the 1st and 21st of September. When the stalks do not exceed 8 feet in height, the cutting is done with an ordinary sweep-rake harvesting machine, by cutting two-thirds the ordinary width of the swath, while a larger growth must be cut with a sickle, corn-hook, or short scythe. It is claimed that a light frost will not injure the crop, and that there need be no haste in cutting it, the plant continuing to grow until the stalks have turned a pale yellow. However this may be the opinion in New York State, where the fibre is

* Northern Hemisphere, of course.

employed in the coarser manufactures, a different idea prevails abroad, namely, that after the proper time for cutting has arrived the fibre deteriorates, and for fine manufactures there would be considerable loss in value.

M. W. B. Hawkins, of Lexington, Kentucky, details the general practice of growers in his State, at the present time, as follows :—

The usual procedure in the cultivation and handling of hemp is about this : Our best land produces the best hemp. Virgin soil sown to hemp can be followed by hemp for fifteen to twenty years successively ; sown then to small grain and clover ; can be sown to hemp every third year (no fertiliser required) almost indefinitely. Given blue-grass sod, plough not over 4 inches deep in the fall or early spring ; sow about the time to plant corn ; sow broadcast 33 pounds of seed per acre, having first prepared the seed-bed thoroughly, and cover by dragging with the harrow, as for any of the small grains, wheat, oats, &c. No cultivation can be done, of course, as it is broadcast.

About 100 days are required for the crop to mature ready for the knife, or when the first ripe seed can be found in the heads. The hemp is then cut and spread thinly, covering the ground it grows upon ; it must be kept from tangling. Let it lie for one or two weeks to cure ; rain will not injure it in this time. Now rake into bundles and tie (be careful to keep straight), about 10 inches in diameter, and stack dry, about 2 acres in the stack. About 1st December we spread on the ground, as before, and when retted sufficiently set upon ends in shocks, about the ordinary size of corn-shocks, and the hands can carry their brakes from one shock to another in the field to brake it out. Much depends upon the retting, and must be determined by testing when it is ready to take up. The approximate cost of an acre of hemp in Kentucky, counting man and steam worth 3·50 dollars per day, is as follows :—

	Dollars.
Ploughing ...	2·00
Harrowing ...	1·00
Seed, at 3 dollars ...	2·50
Cutting ...	3·00
Taking up and shaking ...	3·00
Spreading ...	2·00
When retted, shocking ...	1·00
Braking, 1 dollar per 100 pounds (the usual crop being 1,000 pounds) ...	10·00
Total ...	24·50

[*Report of Secretary for Agriculture, U.S.A.*, 1890.]

Reference to Plates.—Male Plant—A, open flower, showing disposition of stamens. *Female Plant*—A, flower ; B, pistil ; C, seed and section of same.

(116 210-93)

Cannabis sativa, Linn.

Hemp (male plant), after Millspaugh.

Cannabis sativa, Linn.

Hemp (female plant), after Wissett.

(116 210-93)

Notes on Experiments with Hemp (*Cannabis sativa*) in New South Wales.

By G. VALDER,
Department of Agriculture.

WITH the purpose of testing whether hemp is a suitable crop for this Colony, and as to what parts were most favourable for its cultivation, the Department imported a quantity of hemp seed from Messrs. Sutton and Sons, the well-known English seedsmen. This seed was distributed in August and September, 1892, to about 600 farmers in all parts of the Colony, and from reports furnished by them, and from the cultivation by myself of several small plots in the Sydney district, the following information has been gathered:—

Altitude.—Lands having an altitude of less than 2,000 feet gave the best results.

Soil.—Chocolate loam was found to be by far the most suitable soil for this crop, although several very good returns were obtained from the lighter loams; but on sandy soils and clays the crops were, in nearly every case, a failure.

Districts.—The lower portions of the Northern and Southern Tablelands, having an altitude of from 1,000 to 2,000 feet, and the chocolate loams of the Northern Rivers district, gave the best returns, both as to yield of seed and fibre. In several parts of New England the crops grew very strongly during the spring, but the dry summer completely destroyed them.

Sowing.—Sowing took place from the end of August until the commencement of October. In the warmer districts the early sowings gave the best returns, but in the colder districts many of the crops were sown too early, and, as a consequence, they were destroyed by late frosts. Mr. C. Fraser, of Mittagong, reported that his plants were badly injured by frosts on the 14th and 15th December. Mr. F. E. Thomas, of Numeralla, near Cooma, reports that he considers that in no case should hemp be sown before October in his district.

Germination.—Germination took place in from five to fourteen days from the time of sowing. The seed supplied was evidently very good, as the average number of plants obtained was no less than 66 per cent.

Cultivation.—The land was either ploughed and harrowed or deeply dug. In many cases a portion of the seed was sown broadcast and the remainder in drills. If anything, that sown in drills grew the stronger, but there was little difference either way. Only in a few instances was manure applied. Farm-yard, cow and fowl manure, and wood ashes were tried, but the result was very doubtful.

Growth.—The most remarkable feature in these experiments was the very slow growth of the plants, the average being about 6 inches per month. In no case were the plants reported to have grown more than 3 feet 6 inches high, and in several instances the plants flowered and produced seed when only 15 to 18 inches high. At Croydon I made two sowings—one in a paddock which had been ploughed and harrowed ready for a crop of sorghum, and the other in the vegetable garden, where the soil was fairly rich and well worked. Although the plants grew well at first in both places, those in the paddock were only 2 feet high when they matured, whereas the plants in the garden were from 3 feet 6 inches to 4 feet in height, but none of them exceeded this.

Several samples of seed, including two of my own, were brought to the Department, and, on comparing them with imported samples, it was found that the colonial-grown samples were equal to the imported, one sample being superior. The seed was large, even, and of a pale bright colour.

From what I can gather from these reports, and from my own experience, I believe that there are many parts of this Colony where a good yield of seed of first-class quality can be produced. With regard to the fibre, I also think that our rich loams on the coastal districts, and also several portions on the Northern and Southern Tablelands, are very suitable for its production provided that a more thorough system of cultivation is adopted than is usually given to the crops grown there. Fibre of a first-class quality certainly cannot be produced without the following conditions:—

1. A rich loamy soil, or a fairly rich one with manure.
2. A good rainfall. (In all the drier districts in which this crop was tried the plants were very stunted.)
3. Good cultivation. Unless the soil is thoroughly worked and pulverised the plants will not grow strongly.

Native Bread, or Native Truffle.

Polyporus Mylittæ, C. et M., Syn, *Mylitta australis*, Berk.

By J. H. MAIDEN,
Consulting Botanist.

General Description.

Farmers in Tasmania and Eastern Australia not rarely turn up with the plough, near the surface, a substance that they liken in appearance to a potato, a turnip, or even a kind of bulb. To describe its appearance as that of a huge potato (though it is sometimes quite small) is perhaps as satisfactory as any. It has a dark-coloured thin skin, which readily peels off in little flakes as it dries. When quite fresh the substance feels like india-rubber. It is a fungus, and its local and scientific names are indicated above. The fungi vary in shape. Sometimes they are nearly spherical, at other times much indented, while others have the shape of yams. Sometimes, when freshly dug up, they have a fœcal smell, but this soon passes off.

When quite fresh, their consistence is precisely that of a stiff gelatine mould, such as is used for taking multiple copies of letters. It has a pretty, netted appearance, and is colourless and translucent. In Mr. Southall's paper (presently referred to) it is stated: "The accompanying figure of a transverse section is founded upon that in Corda's *Icones Fungi*, but the hexagonal character of the pits is not preserved." He quotes Mr. Berkeley: "Before drying, the solid and fleshy mass presents a multitude of regular pits, generally hexagonal, large, and filled with a semi-transparent pulp of a watery white, having something the appearance of melted wax, and is soft enough to spread under the spatula." [I have never seen one of such a consistence.—J.H.M.] "The walls of the pits are formed by a substance pure white, opaque, and somewhat corky, which does not divide readily or regularly any way. The same parenchyma is extended to within about 3 or 4 millimetres of the periphery of the fungus."

In regard to the above passages, I have not access to Corda's work, but with regard to Mr. Southall's drawing, and the remarks as to the hexagonal appearance of the transverse section, I would like to say that such hexagonal appearances are not confirmed by my own experience, and very many native breads have passed through my hands. At the same time, I do not for a moment impugn the accuracy of the authorities referred to. Figure 2 shows the netting to be quite irregular. (I have never seen any which may be termed even approximately hexagonal.) It will also be observed that the veining almost extends to the periphery (it actually does extend to the periphery in parts); in Mr. Southall's figure it comes far short of the periphery, an appearance which I do not remember to have seen.

Is it a Food?—In the mouth it feels granular, like half-boiled sago. It is tasteless, or, at the most, has a *soupçon* of acidulousness when fresh. The aborigines used to use it for food, but it is, however, perfectly insipid, and not calculated to tempt the appetite of the white man. In the catalogue of Tasmanian exhibits at the great Exhibition of 1851, it is stated that in a half-roasted condition it formed a portion of the diet of the Aborigines, and and that it has been successfully tried in soup and puddings by Europeans. If used at all, it would have to be used when it is quite fresh, as it becomes exceedingly hard and horny when dry. I have subjected it to a brief chemical examination, of which the results are noted below. I believe the native bread to be almost absolutely incapable of being acted upon by the gastric juice of the stomach of either a black man or a white, and therefore its nutritive value is imaginary.

Size.

Most of the native truffles of which any account has been given have been found in Tasmania, though I am not aware that they are more plentiful in that colony than in Victoria and Eastern New South Wales. Mr. W. H. Breton exhibited at a meeting of the Tasmanian Society a specimen weighing 25¼ lb., which had been dug up near Launceston (*Tas. Journal*, ii, 463, 1846). Another Tasmanian specimen, shown at the Exhibition of 1851, weighed over 14 lb. when dug up. The specimen described by Mr. Southall (referred to below) was sent by Mr. A. P. Miller, of Hobart, and is stated to have weighed no less than 39 lb. "The largest I have seen is about the size of a child's head, but a much larger one was dug up at Melbourne some months ago."—(*Rev. Dr. Woolls*, 1859). Mr. Warden Willshire of Berrima, has recently sent to the Department a native bread found at Bundanoon. The largest circumference is 24¼ inches, and smallest 20¾ inches. It weighed, when received, 5 lb. 14¾ oz. Mr. R. T. Baker informs me that he found one at Burrawang as large as a man's head, at which the residents expressed no surprise, saying they were accustomed to find them considerably larger; but most of the specimens sent to museums by country residents for determination weigh from 1 to 5 lb. when fresh.

This fungus is usually met with by accident. When growing rapidly, it sometimes causes the ground to crack, and may thus be discovered by a careful observer, as it probably was by the Aborigines. The natives informed Mr. Backhouse that they obtained it from the neighbourhood of a rotten tree. The specimen depicted in Figure 3 was dug up in the Dandenong Ranges in Victoria, and is remarkable as showing the decaying root *in situ*. The root of the tree was that of a Messmate (*Eucalyptus amygdalina*.) Now-a-days, it is usually turned up by the plough, as has already been mentioned.

At the Linnean Society's meeting of the 28th September, 1881, the Hon. William Macleay exhibited a "native bread," about 6 inches in diameter. "He stated that the specimen had been dug up on the Blue Mountains by the Hon. James Norton, and he expressed a doubt as to its edible qualities, notwithstanding the name given to it."—(*Proc. Linn. Soc., N.S.W.*, vi, 749.)

Chemical Examination.

The only observation I can find in regard to the composition of this fungus is by Mr. Southall. An allied fungus, which is found in the United States, and which is known as Tuckahoe, or Indian Bread, and whose botanical name is *Pachyma Cocos*, was analysed by Professor Ellet, of the

South Carolina University, and found to consist of nearly pure pectin. In allusion to this, Mr. Southall mentions that (presumably referring to *Mylitta australis*), he has "repeated Professor Ellet's experiment affirmatively as to pectin." I have also examined Tuckahoe, and find it to consist of pectin, or, at all events, of pectose bodies. But if Mr. Southall's remarks apply to *Mylitta*, I do not confirm them. My specimen of native bread (*Mylitta*) contained at the time of testing 78·68 per cent. of water, and ·77 per cent. of ash, which, although so small, is rich in phosphates. It does not contain nitrogen in any form. A very small quantity of the fungus is dissolved in cold water after forty-eight hours, nor does boiling appear to have any more effect, even after several hours, this fact alone pointing to the almost complete absence of pectin. It is practically unalterable in water, or, in fact, in reagents. When cut into pieces and placed in liquids, no swelling takes place, and the cut edges lose none of their sharpness, nor does the substance soften. Dilute solution of hydrochloric acid acts little upon it, the small portion soluble after several hours boiling being precipitated on making the solution alkaline. A boiling dilute alkaline solution only takes up a very small proportion of pectic acid, which is precipitated on acidifying the solution. The native bread (*Mylitta*), therefore, contains a small proportion of pectous substances, and can be only of infinitesimal nutritive value. It is immaterial whether it is eaten raw or boiling, and cold or hot water is equally ineffective in acting upon it. I consider the native bread to consist mainly of a modification of cellulose, most probably *fungin*, my other experiments, which need not be reproduced here, pointing to this conclusion.

The native bread (*Mylitta*) is, therefore, not to be compared in nutritive value to Tuckahoe (*Pachyma*), which consists almost entirely of pectose bodies, and, as far as these preliminary experiments go, the chemical composition of this native bread appears to be *sui generis*. Later on I hope to continue my investigations on this interesting substance.

Literature.

The native bread was first described by Berkeley in the *Annals of Natural History*, iii, 325, where he says, "This is the species of tuber mentioned by Mr. Backhouse. I have no doubt that it is congeneric with *M. pseudacaciæ*." He again alludes to it in the proceedings of the Linnean Society of London, iii, 1858.

A botanical description will be found in Dr. M. C. Cooke's *Handbook of Australian Fungi*," page 248, but it is too technical for reproduction here.

In the 13th vol. of the Journal of the Linnean Society of London, 1873, page 175, the Rev. M. J. Berkeley describes a form of *Mylitta australis*, which he terms *minor*. He says, "From the garden of the Rev. Mr. Howard, Beechworth, Victoria. A much smaller plant than the original form, not exceeding 1½ inch in diameter, globose or flattened. I can see no distinctive character."

Very little detailed information has been published, as far as I am aware, in regard to the native bread, and I believe the following paper on the subject is the best that has appeared: "Note on a Specimen of *Mylitta australis*," by William Southall, in the *Year Book of Pharmacy* for 1884, page 524. The paper was read before the British Pharmaceutical Conference of that year. It is illustrated by a figure of the transverse section of a native bread, and figure and paper are reproduced in the *Pharmaceutical Journal* [3], xv, 210, 13th September, 1884. This is the paper alluded to above.

Allied Fungi.

Fries describes a *Mylitta pseudacaciæ*, from *Acacia* branches, Tasmania, but Dr. Cooke refers to it as "some excrescence, not a true *Mylitta*."

Mylitta lapidescens is found in China, and, as might be expected, it is used for all sorts of complaints in that country. In Southern India it is also used medicinally, but it may be said, once for all, that these fungi cannot possess medicinal properties. There is another supposed *Mylitta*, from India. For some brief notes on it, see "Fungi; their nature, influences, and uses": by Cooke, edited by Berkeley, 3rd Edition, p. 102."

A well-known fungus is the Tuckahoe, or Indian bread (*Pachyma Cocos*) from North America. It is composed almost entirely of pectin, or, at all events, of pectose bodies. It is found in North America and China, and perhaps in other countries. The fungus of this class best known of all is, however, the common truffle of Europe (*Tuber æstivum*), which need not be dilated upon here.

Supplementary Note.

The preceding paper was written before the publication of Mr. D. M'Alpine's interesting note on "native bread," at p. 291 of the issue of 20th September, 1893, of *The Australasian Journal of Pharmacy* (Melbourne). It appears that last year the fructification of this fungus, which has been looked for for half a century, has been found, and the generic position of it can be now given, Messrs. Cooke and Massee assigning it to *Polyporus*, and its botanical name now is *Polyporus Mylittæ*, while the time-honoured name of *Mylitta australis* must be superseded. "Dr. Cooke received from South Australia a mushroom-like body growing out of the sclerotium (native bread). This was the much desired and long-looked for fructification. It was pure white in colour, fleshy in consistency, and differed from the mushroom in producing its spores in pores." Another Australian mystery has been unveiled. Who will have the honour of finding the first native bread fructification in New South Wales?

Our Illustration.

The specimen from which the drawing was made was ploughed up by Mr. W. Gow, near Rydal, in September, 1893. Its weight on the 14th of that month was precisely 21 oz.

Figure 1 shows the external appearance of the fungus, and how the outer dark skin is cracking and peeling off in small thin flakes.

Figure 2 shows the netted appearance of the fungus in transverse section.

Figure 3 shows the fungus *in situ* on decaying root of tree.

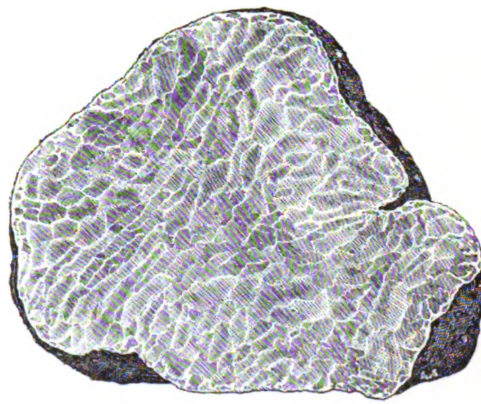

Fig. 2.

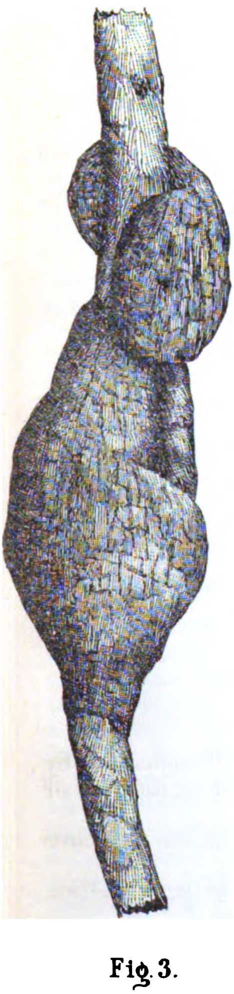

Fig. 3.

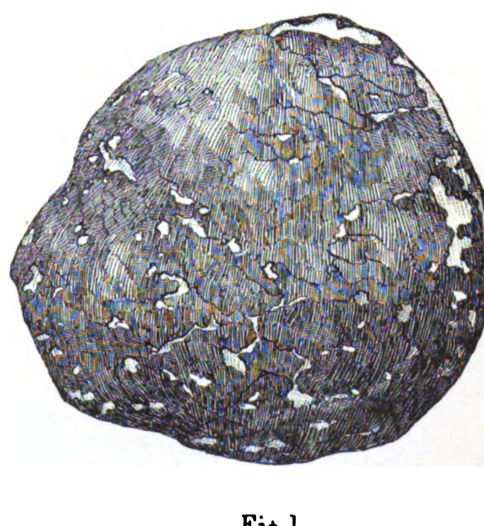

Fig. 1.

Polyporus Mylittæ C. et M.

Syn: Mylitta australis, Berk.

"Native Bread" or "Native Truffle."

(116 210-93.)

Botanical Notes.

BY J. H. MAIDEN,
Consulting Botanist.

THE WEED KNOWN AS "FUMITORY."

MR. G. H. GREENE sends a weed from Manar, 12 miles north of Braidwood, found growing among the wheat. It is a small, weak-growing plant, which, however, grows in great masses under favourable circumstances. It has finely-cut foliage, and small, peculiarly-shaped, purplish flowers, which are succeeded by roundish fruits. It is known as Fumitory, and to botanists by the name of *Fumaria officinalis*; natural order, *Fumariaceæ*. It is an exceedingly variable species, and hence is subdivided into other species by some authors. It is a weed of cultivation pretty well all over the world, being introduced to farms in the first instance by means of dirty seed. In the old country it is found more or less wherever cereals are cultivated.

It is not poisonous, but the careful farmer will clean it off his land, as it is utterly worthless, smothers young plants or deprives them of nutriment, and produces any quantity of seed. There is one comfort—that its presence is usually a sign of good land.

THE WILD PARSNIP AS A POISON PLANT.

A CORRESPONDENT writes from Mungunyah, 10th October:—There was a heavy bush-fire two years ago which burnt certain leases out clean; since then nothing has grown but rubbish. We had 3 inches of rain about nine weeks ago, and nothing whatever has grown but this plant, which looks like a lucerne field from a distance; it grows to about 18 inches high, and is very green." The plant is often known as "Wild Parsnip." Its botanical name is *Trachymene australis*, and it belongs to the natural order *Umbelliferæ*, which includes both poisonous and edible plants. The wild parsnip is unfortunately too well known as poisonous to stock. It caused the death of a large number of cattle at Dandenong (Victoria) in December, 1887. Its action is so powerful that no remedial measures seem to be of any avail. The only way to destroy the plant is to pull it up by the roots and burn it. The plant as received was full of seed—some of it quite ripe. It is unfortunate that it should have been allowed to arrive at that stage, for umbelliferous plants seed freely, and the old proverb says, "One year's seeding, seven years' weeding,"—a very serious matter indeed with a poison plant. This plant will be figured in the *Gazette* and further described at an early date.

A PLANT SUPPOSED TO BE INJURIOUS TO BEES.

THE common "catchfly" of England (*Silene gallica*), a small, pink-flowered, hairy plant, which is an exceedingly common weed in this Colony, is credited by some bee-keepers on the Hunter River with causing paralysis in bees. Have any readers of the *Gazette* any evidence in support of this?

Experiments with Pulses

(*Continued from page 858.*)

BY GEORGE VALDER,
Department of Agriculture.

2. Mung Bean (*Phaseolus mungo*, Rox.)

FOUR varieties were sown on the 8th October, 1892. The seed of each variety was very good, the plants coming up very evenly. The seed was sown in drills 18 inches apart, and the plants were thinned out to 6 inches apart. This crop is evidently well suited for cultivation here, the plants growing strongly and requiring very little attention. All the varieties were in full flower the first week in December, and the crops were ready for harvesting about one month later. The plants were pulled up and laid in the open to dry for two or three days, and the pulse was then threshed out, the following returns being obtained:—

No.	Name of Variety.	Seed obtained from—	Number of days in which the crop occupied the land.	Yield of dry pulse per acre. Bushel of 60 lb.
1	Light brown	Queensland	93	13
2	Dark green	"	102	26½
3	"	India...	107	22
4	Light green	New South Wales ...	88	35

As will be seen on reference to above table the light green variety proved to be much superior to the other varieties in yield, and also quicker in maturing. The pulse also is larger and more even in size. A few weeks before harvesting this plot presented a very curious sight, the plants being thickly covered with the black pods. The average height of the plants was about 18 inches when full grown. I shelled out a dish of the beans when the pods were fully formed, and had them cooked and served up in the same manner as green peas, and found that they were very palatable. I do not, however, think that they will ever be used largely for this purpose, as it takes too long to shell them out, the pulse being so small. From my experience with this crop, I am confident that it can be grown successfully in all but the very cold parts of the Colony, but I do not think it is likely to be grown extensively, as there are so many more suitable pulses already under cultivation. In India the pulse is ground into flour and is then made into cakes, but I am afraid that it would take a long time to educate the taste of the people of this Colony in this direction so that the pulse would be in large demand. The average number of pods on a plant was 117, and the average number of beans in a pod, eleven. The Queensland samples were presented to the department by Mr. Bailey, the Colonial Botanist; the Indian

sample was taken from a quantity imported by the department; and the New South Wales sample was presented by Mr. C. E. Wilson, of Carcoar, who had grown it under the name of "Curry Bean."

3. Soy Bean (*Soja hispida*, Mœnch.)

Seeds of three varieties were obtained, viz., "Common White," obtained from a local seedsman; "Improved White," from the United States; and a black variety from Queensland. These were sown in drills 2 feet apart, and the plants were thinned out to 1 foot apart in the drill. At first the plants grew rather slowly, but as the weather became warmer the growth was more rapid. When about 15 inches high the plants of "Common White" and "Black" were badly attacked by bean-rust, but, strange to say, the plants of "Improved White," which were growing next to these varieties, were not affected in the slightest degree. The "Improved White" variety appeared to be well suited for this climate, as the plants grew very rapidly. In fact, I was inclined to think that they were making too much leaf, and that the yield of pulse would, therefore, suffer, but from the results obtained it will be seen that this could not have been the case. So badly affected were the other two varieties that I was afraid they would not seed, but heavy rains soon after they commenced flowering somewhat revived the plants and a fair return of pulse was obtained, but the yield must have been much impaired by the disease. When fully grown the plants of the "Improved White" variety were from 3 feet to 3 feet 6 inches in height, and nearly 2 feet through 9 inches from the top of the plant. The stalks are strong and woody, and they have numerous branches covered with heavy foliage. The stalks and branches are thickly studded with clusters of hairy pods. In order that a fair idea of the productiveness of these plants might be obtained, I counted the number of pods and number of beans on each of the first six plants in the drill with the following result:—

No. 1 plant	182 pods,	containing	443 seeds.
" 2 "	237	"	679 "
" 3 "	209	"	586 "
" 4 "	284	"	781 "
" 5 "	241	"	663 "
" 6 "	262	"	735 "

This would give an average of 235 pods on each plant, containing 648 seeds. Average number of beans in a pod, 2·7. Most of the pods had three beans in them. One branch on plant 4 had no less than 114 pods on it. A portion of the plants were fed to cattle just as they came into flower, and I found that they were preferred before any other pulse which I had growing.

The remainder were pulled as soon as the pods were ripe, and were laid out in the sun to dry; the pulse was then threshed out and the dry haulms were fed to cattle, who appeared to be very fond of them. The results obtained will be found in the following table:—

No.	Name of variety.	Seed obtained from—	No. of days in which the crop occupied the land.	Yield of dry pulse per acre, in bush. of 60 lb.
1	Improved White ...	United States ...	148	47
2	Common " ...	Sydney	135	13*
3	Black	Queensland	127	9*

* Badly affected with bean-rust.

The only fault that I could find with the Soy bean was that it was too slow in ripening its seed, it being nearly five months in coming to maturity, but I noticed that the plants grew best during the month of January, especially during one hot dry week, and I, therefore, believe that this plant is best suited to the warmer parts of the Colony. I should strongly recommend farmers to plant a small area with this crop, as the beans shelled out when quite green form a delicious vegetable, and the plants after the pods are taken off make very good feed for cattle.

The department obtained a small quantity of seed of the common white variety and distributed it to a number of farmers in different parts of the Colony. The seed germinated badly, but most of the plants that were obtained grew remarkably well.

Mr. J. Allison, Eglinton, Bathurst, reports as follows:—The seeds received were very deficient in vitality, only three plants coming to perfection. These proved very vigorous and prolific, reaching a height of from 2 to 2½ feet, and bearing a quantity of delicious beans. I think this will prove a real acquisition to the list of choice vegetables.

Mr. J. Taylor, Reedy Creek, Rylstone, says:—"The Soy bean grows well in this district, attaining a height of 3 feet 6 inches, and being covered with pods. In fact, so heavily a crop did the plants bear that I was obliged to put in stakes and tie them up, in order to prevent the plants being broken down. The beans are delicious eating."

Mr. Charles Mapperson, junr., of Tattaila, Moama, states that he believes the Soy bean will stand the hot summer weather better than any other bean which he has yet tried, but it must be sown in the early spring.

4. Chick Pea or Gram (*Cicer arietinum*).

Two samples of the red-seeded variety and one of the white were sown. The white variety was imported from Europe, and one sample of the red from India; the other red sample was grown by Mr. Niblock, of Cooma, from seed supplied him by the department. The seed was sown in drills 18 inches apart by 4 inches apart in the drills. The cultivation given them was similar to that usually adopted for dwarf field peas. The seed germinated in from five to six days, and the plants grew rapidly, the whole plot being well in flower in about six weeks from the time of sowing. The red variety has pink flowers, and the white-seeded one pure white. The fern-like foliage of these plants gave the plot a very distinct and pretty appearance. As soon as the pods were fairly ripe the plants were pulled up and laid in the sun to dry. The pulse was then threshed out, and the following results obtained:—

No.	Name of variety.	Seed obtained from—	No. of days in which the crop occupied the ground.	Yield per acre. Bush. of 60 lb.
1	Red-seeded	India	93	27½
2	"	Cooma, N.S.W. ...	88	32
3	White-seeded ...	England	97	21

Red-seeded variety is the hardiest, quickest in maturing, and best yielder of the two varieties. It is of little or no value as a vegetable, although it makes very good pea-meal for soups. It is considered a good pulse for horse feed, and is also a capital change feed for poultry. As a green food it

is of no value, and I do not consider that it would be of much value as a green manure, the yield of greenstuff being very small in comparison with other pulses. I should recommend its cultivation in all but the very cold parts of the Colony as it is a quick grower, will yield two crops in the one season on the same land, maturing in about ninety days, stands heat and drought well, and bears a heavy crop.

White-seeded variety.—This variety is the one which is largely grown in the south of Europe, where it is used in soups and as a vegetable. The plant is taller and more robust than the red-seeded variety, being about 18 inches high by about 10 inches through, whereas the red-seeded variety was only from 12 to 15 inches high by about 6 inches through. I shelled out several dishes of the peas and had them cooked in the same manner as garden peas, and also tried them in soups. The flavour is much the same as that of the common pea, but it requires more boiling. I consider that it is worthy of cultivation on a small scale during the hot summer months when the common pea is scarce, but at any other time it is not equal to the common pea, as it does not yield as well, and the peas are more trouble to shell out, there being only two peas in a pod.

One drawback to the cultivation of the chick pea is that it is very liable to the attacks of a small caterpillar, which bores into the pods and eats the peas, but, of course, this trouble can easily be got rid of by the application Paris green.

5. Horse Gram (*Dolichos biflorus*, Linn.)

Three samples were sown, two of the yellow variety and one of the black. One yellow and the black sample were obtained from India, and the other yellow one from Queensland. About 80 per cent. of the seeds germinated. The plants grew very slowly at first, but grew faster during the hot weather, and attained a height of about 3 feet. At this time the plants, which are of a climbing habit, had become a complete mass, and it was impossible to separate the varieties. However, as the growth of the three samples sown was about the same in every way, I decided to cut a portion and estimate the yield of greenstuff per acre. This was done on the 25th February. The result was 4 tons 13 cwt. per acre. As the crop was nearly five months occupying the land before it was ready to cut, I consider that it is a very poor return in comparison with that of the cow pea, which was growing close to it, and was treated in the same manner. Horses and cattle eat it readily, but much prefer the soy bean and cow pea. The remaining plants made little or no further growth, and at the end of March they gradually died off. They did not show any signs of flowering, although occupying the ground for nearly six months. This crop might, perhaps, be valuable in the warm, dry parts of the Colony as a forage, but I do not think it would ever be of any value for its pulse.

(*To be continued.*)

Heredity in Bees.

By W. ABRAM,
Italian Bee Farm, Beecroft.

In his article on "Heredity in Bees," Mr. Gale declares: "The subject of the difference of the constituents of the bee-hive have occupied my attention for years past; and long since have I come to the conclusion that the food theory is wholly untenable." He undertakes the task to explain facts in support of other more important factors, and declares them to be more important, relatively, than the food theory. He is lead to this conclusion by noticing "that the efforts of Nature to mature a queen are almost opposite to those to mature a worker bee, and that the aids Nature uses in the one case are almost entirely changed in the other." Mr. Gale asks: "What produces these, and a score of other differences?" And Nature gives him this answer: "The porousness of the queen cell; the absence of cocoon from the larval queen's abdomen; the extra size of the cell, the cavities of its external surface; the position of the queen within—all have more to do with the development of the generative organs of the queen, than feeding with larger quantities of food."

I differ from Mr. Gale, because the larger quantity, and the quality of food given to a queen larva, are so clearly points of fact that no practical bee-keeper can ignore them. In a long and extensive practice a bee-keeper has opportunities of noticing many things which the novice has no idea of. I have seen queen-cells of all sorts of shapes and sizes. I have let queens emerge from cells from which they could never have liberated themselves, because the queens were in a most unusual position in the cells, with the head upwards, and I have seen queens take from nineteen to twenty days to hatch. But, although these cells were of various sizes and various shapes, and the queens occupied positions entirely contrary to Mr. Gale's statement, quite perfect queens developed, because the main factor, *the food*, was abundant. A queen developed in a large cell is neither larger nor superior to her sister, which occupied a small cell. Very often bees are required to build queen-cells upon worker-cells containing young larvæ. These are surrounded by worker brood, and, therefore, lack the conditions essential to their development, according to Mr. Gale. Moreover, these eggs are never intended for queen progeny at the time of being deposited; nevertheless, queens hatch from these cells equal to those reared in natural cells, provided food is supplied them of the proper kind by the bees.

That the size of the cell is immaterial, so long as it is not too small to hold the quantity of food and the natural-sized insect, is also shown by the fact "that worker-bees reared in drone-cells are not particularly in excess of ordinary bee size, and *never anything else but worker-bees*." I have more than once bred bees in drone-cells, and I have now a small piece of such

brood in spirit ready to submit to any test. Again, I have seen worker-cells containing nymph free from any covering, so that fresh air had access in abundance, but with no other result than rearing worker bees. All these facts declare against Mr. Gale's assumption.

The quality and quantity of food are undoubtedly the main factors in the development of a queen. In times of scarcity the consequence is fatal. The required temperature is always present where breeding takes place. I have seen queen-cells reared, while the outside temperature stood far below freezing-point, with good results; but if during the later period of the queen's development the required amount of warmth had been withheld, retarding to some extent the queen nymph, she would have hatched from three to four days later than usual. It will thus be seen that the conditions and agencies vary, but the result is the same, as long as the required quantity of food is present. If the conditions and agencies have all the influence upon the constructive and mental characteristics Mr. Gale declares them to possess, then why should in-breeding prove what it always does—an ultimate failure and retrogression? The conditions and agencies are unaltered, but the result is utter ruin, because heredity in character is due to different causes, and not what Mr. Gale assumes.

Now, let us see whether the quantity and quality of food vary as do the conditions and agencies, and mark the result. We find that brood food consists of albumen-substance, fat-substance, and sugar-substance. Of the three different constitutents the queenly larva receives the highest percentage of albumen. Before the cell is sealed over it has fully fifty times more food—rich in albumen—within its reach for consumption, than the worker larva receives. This is the only practical and natural answer as nature declares it, and must be the main reason why the organism of a queen differs from that of a worker. Whatever else appears is due to nature, and not to extraneous circumstances. In their germination both are alike. Both are alike up to five days old, as regards mental and constructive character; both are fed on food of almost the same quality, only the queen larva gets a greater quantity than the worker larva. Henceforth a change takes place. The cell which contains a queen larva is enlarged and extended downward, and the same quality of food as hitherto is given in greater proportion; while the cell of the worker larva remains small, and the quality of food changes materially. The great quantity of food required for the development of a queen explains the reason for the largeness of the queen-cell. Where else would the bees store the amount of food? The queen does not require, nor could she fill the space. Any queen-cell is large enough for a queen.

The food for the queen larva is freed from any indigestible substance. It is semi-digested, and its quality is always the same—of equal proportions—no matter whether the larva is in her first stage, from one to four days, or from four to seven days of age. This is of importance. But the quantity of food varies according to the time of the season, the strength of stocks that rear queens, &c.

That a natural queen-cell usually presents the form of an inverted cone finds its explanation in this: The bees when building their combs have no consideration for queen-cells. These combs are built for other purposes, and there is not much more than bee-space between each comb and hive or frame left. When the desire for queen-rearing arises, the bees utilise some of those spaces between comb and hive, or frame, and they mostly use the edge of the comb to build the queen-cell. If now space permits to continue these cells straight down, they do so; but if not, as when near the bottom of the

comb, then the cells are bent horn-shape, with no bad result whatsoever. The bees cannot well build upwards, therefore, instead of an erect cone, a queen-cell represents an inverted one. Besides, the larva might get drowned in the quantity of liquid food were the cell upright. But a different form is necessary to indicate the importance of its occupant.

The worker larva is fed on semi-digested food, similar to that of the queen larva, for the first four days, but, thenceforth, the albumen and fat are decreased, and the sugar increased. Why so? Because the larva has to develop into a worker-bee, and its food must be rich in respiration material. Is this wonderful preparation a matter of nature's law, or is it intentional? If we take into consideration that during the height of the breeding-season there are in a hive from 10,000 to 20,000 larvæ to be fed daily, and some 2,000 to be sealed, we must indeed admire the development of heredity.

The drone larva receives for the first four days likewise semi-digested food, which is even richer in albumen than that of the queen larva, but from the fourth day more raw material in the form of pollen and sugar is given.

In looking back upon Mr. Gale's statement regarding the agencies of food, the sexual organs of workers ought to attain greater perfection than those of the queen, because the former receive more heat-producing material than the latter.

In submitting the above information to the readers of this journal I have intentionally refrained from any remarks regarding mental characteristics. We have no alternative but to accept nature's law, which proves that in bee-life *all fertile eggs possess the characters required for a mother*. Still there are in nature certain matters which the Creator has wisely hidden from our observation. These are but simple statements, devoid of questionable terms and hard quotations, and ordinary minds may understand what I have written. Mr. Gale's article, on the other hand, may do for learned men, but will not suit practical bee-keepers like myself.

Manufacture of Condensed Milk as a Proposed Colonial Industry.

By E. CLARENCE WOOD,
Hawkesbury Agricultural College.

The very extensive use of condensed milk in New South Wales, as testified by statistics of the annual imports, is alone sufficient to warrant the most careful inquiry into the problem of its local production from our excellent pasturages; yet much more interest and importance attach to the question in view of a possibility of creating an export trade in this article, which, once established, would probably become a wide field of employment peculiarly suitable to Australian life. I have, therefore, considered it of the first importance to be as exact as possible in my experimental work and observations, and in most cases I have confirmed the results by repetition.

In respect also of the fact that separated milk as a by-product of our numerous butter-factories is not utilised in any manner that can be regarded as commercially economical, and that when converted, as in other countries, into condensed milk it has a certain value as an article of diet—being in fact imported here—it is urgent that precise information should be laid before colonial dairymen concerning methods for a more profitable disposal of this valuable by-product; for it must be admitted that in the direction of its use for human consumption in a refined state there are better prospects than for fattening pigs and young stock on the farm, or for making cheese.

It will be interesting in the first place to trace the variations in the value of milk as it is converted: (*a*) into butter; (*b*) into condensed milk; (*c*) into both of these; and (*d*) into butter and skim-milk cheese.

It is universally admitted that the daily sale of the fresh milk direct to the consumer is the most profitable part of the ordinary dairying business. In this there is a disposal of the whole without waste or by-product; the operation is simple, and there are no heavy working expenses, nor very expensive plant, though irregularity of seasons frequently renders it difficult to retain customers, or at least involves extra expense to do so, and the area supplied is limited even with the railway. The wholesale price realized for fresh milk may perhaps be assumed at 6d. per gallon. Allowing 2½ gallons of milk for the production of 1 lb. of butter, valued, say at 9d., and assuming the skim milk to be valueless, we have 9d. as the return for 1 lb. of butter to place against 1s. 3d. for the milk from which it was taken, not to speak of additional labour and machinery in the butter-making. Or if these figures be objected to, it may be generally assumed that butter is worth less than the milk from which it is derived. With butter, however, it must be remembered that it can be stored a considerable time, and that its price is likely to vary in such a manner as to entail no loss to the producer through irregularity of seasons; also that the area supplied is not limited.

Turning now to the manufacture of condensed milk from whole milk, it may in the first place be noted that the process is simple and concise. There is no by-product, and as an industry it has facilities in respect of the indefinite length of time the article will keep, as compared with butter and fresh milk, and the area supplied is limited neither by latitude nor longitude. The wholesale price of 1 lb. of best condensed milk may be assumed at 6d. Deduct 1d. for the sugar it contains, which gives 5d. It requires not more than 3 lb. of an ordinary sample of fresh milk to make 1 lb. of best condensed milk, and the wholesale cost of same is less than 2d. Therefore, we have 2d. as the return for a certain quantity of fresh milk to place against 5d. for it in the condensed form. Its value is thus increased 150 per cent. by condensation, whereas it is discounted 40 per cent. by conversion into butter.

This discount is probably only endured by reason of the fact that, though 6d. per gallon may be realised, the produce is generally more than the demand; but this is the point of division which makes butter-making and milk-producing quite separate industries. Butter-factories are not located in positions which would be convenient to supply milk from, but where the milk is most cheaply raised, and their purpose is to treat milk in quantities which are largely in excess of the demand for fresh milk. It must, however, be distinctly understood that the above figures by no means show the relative profits of condensing milk as compared with butter making; they only show the comparative values of these two products in the market. In order to arrive at the relative profits of the two industries deductions have to be made for interest on larger capital laid out in plant for milk condensing, the greater length of time occupied by the process, and the additional expense of canning, labelling, testing, &c.

We have yet to estimate the value of the balance of the milk after butter-making. The buttermilk is of so small a quantity that it may be neglected, though it is highly nitrogenous, and has a certain feeding value on the farm. The separated milk may be estimated in respect of its value both for making skim-milk cheese and for making condensed milk. It is assumed that skim-milk averages 90 per cent. of whole milk, that 1½ gallons of skim-milk yield 1 lb. of skim-milk cheese, and that the cheese is worth 4d. per lb. wholesale. Two and a half gallons of whole milk would thus produce 1½ lb. of skim-milk cheese, the value of which is 6d., in addition to the 9d. worth of butter before mentioned; that is, the butter and skim-milk cheese, when made, are worth no more than the whole milk used to make them.

Two and a quarter gallons skim-milk (derived from 2½ gallons of whole milk) yield 5¾ lb. of condensed milk, the value of which, at 4d. per lb. wholesale, is 1s. 11d. Deducting 5d. for sugar in same, gives 1s. 6d. the value of condensed milk obtained from 2¼ gallons of skim-milk, or the by-product of 1 lb. butter, as against 6d. for cheese from same. Thus, the value of whole or fresh milk is increased about 80 per cent. after conversion into butter and condensed milk.

A comparison of the merits of whole and skim milks for making condensed milk will be useful:—12 lb. of whole milk yield about 4 lb. of condensed milk, at 6d., equals 2s., and deducting 3d. for sugar, it comes to 1s. 9d. Again, 12 lb. of skim-milk yield about 3 lb. of condensed milk, at 4d., equals 1s., and deducting 2d. for sugar, it comes to 10d. The comparative merits are, therefore, about as 21 : 10 as far as raw material is concerned.

Regarding labour and cost of plant, these require no comment as far as fresh-milk-producing and butter and cheese making are concerned. The

appliances for condensing, though more costly than those for butter or cheese-making, would probably not exceed that of a complete plant to make both the latter, and the management would require neither more hands nor more skill than butter-making—far less skill indeed than cheese-making, as may be seen from the following outline of the process:—The milk is received, strained, and run gently into the vacuum-pan, into which the necessary amount of sugar has previously been put. The air is then exhausted, and the temperature kept at about 60° C. (140° F.) by means of a steam or water jacket or coil. When the proper consistency has been attained the condensed milk is run off into the tins. There is a worm condenser connected to the vacuum-pan, which requires no attention. The process of condensation would occupy about three hours.

A difference should be noted in the terms "preserved" and "condensed," as the former does not necessarily involve the process of evaporation or condensation: it has a wider meaning, as the preservation may be secured either by adding substances such as salicylic acid and boric acid, or by evaporating the bulk of the water, or by a combination of these, as in adding sugar and extracting water.

Condensed milk may be either plain or sweetened. The latter is by far the most commonly used, and it has the great advantage of keeping after the tin has been opened. The plain variety cannot as yet be considered very suitable either for Australian manufacture or use. It is liable to putrefactive decay in tins, more especially in warm climates. Neither has it the same commercial prospects as an industry. As a mean of the results of my experiments in making it, it is, when brought down to the most approved consistency—that of thick honey—only 19 per cent. of the whole milk treated. But it must be admitted that it is *the ideal* form of condensed milk, and if successfully made on a large scale its value would be double that of the ordinary kind. When carefully made it will dissolve completely in water, yielding a milk hardly distinguishable in colour and flavour from milk that has been one or two hours drawn. There is every good reason to hope that a plain condensed milk may yet be manufactured with keeping qualities quite equal to those of the sweet kind.

A suggestion might here be offered concerning the utilisation of separated or skim milk. In the course of my experiments in condensing it without sugar, an examination of it at a stage when it had lost half its weight by evaporation showed it to be a very close imitation of and substitute for whole milk. The temperature not having been above 58° C., none of the albumen had coagulated; the only change was due to the loss of water; the taste resembled that of whole milk, though slightly sweeter, and in appearance it was rich and had "body." An analysis of it in this condition was as follows:—

Water	81·64	per cent.
Butter fat	0·62	,,
Casein	6·62	,,
Milk sugar	9·54	,,
Mineral matters	1·58	,,
	100·00	

One very important feature was its improved keeping quality, the time it would keep being certainly double that of fresh whole milk.

Such a milk may be regarded as a compromise between fresh and condensed milk—a kind of "half-extract" or "panned" milk. Its value would be higher than that of whole milk, probably 8d. per gallon, *i.e.*, 9d. would be

the value of $1\frac{1}{3}$ gallons, obtainable from $2\frac{1}{4}$ gallons of skim-milk, the by-product of 1 lb. butter. By this means $2\frac{1}{2}$ gallons of whole milk would, by conversion into butter and "half-extract" milk, be increased in value from 1s. 3d. to 1s. 6d., which is 20 per cent., as against no percentage increase for butter and skim-milk cheese, and 80 per cent. for butter and condensed milk. Then taking into account the labour, it appears that there is a very safe margin, and that it would afford a means of highly utilising skim-milk, especially when it is considered that there would be no cost for tins. The time required for evaporation would be rather over one hour, much less than for making skim-milk cheese.

We have, on the other hand, to bear in mind the additional plant, which indicates that the system would only be suitable for large factories. As an article of diet, such milk, as compared with ordinary fresh milk, is much more concentrated, *i.e.*, less watery. It has about one-fifth the amount of fat, and twice the amounts of albumin, lactose, and mineral matters, this being the whole composition. These differences severally account for its superior keeping qualities.

If separated milk has been "panned" (vacuum) to lose one-third of its weight of water, the composition becomes:—

Water...	86·24 per cent.
Fat	0·46 ,,
Casein...	4·97 ,,
Lactose	7·15 ,,
Mineral matters	1·18 ,,
	100·00

And a comparison of this with fresh whole milk shows it to contain about the same or rather less water, only one-eighth the amount of fat, and 50 per cent. more albumin, milk-sugar, and mineral matters respectively. Its value may be reckoned at 4d. per gallon wholesale. The $2\frac{1}{4}$ gallons of skim-milk, as the by-product of 1 lb. of butter, yield $1\frac{1}{2}$ gallons of it, the value of which is 6d. Thus, $2\frac{1}{2}$ gallons of whole milk, value 1s. 3d., after conversion into butter and "panned" milk are worth the same, and the same as if converted more laboriously into butter and skim-milk cheese.

These two forms of panned milks are far superior to the milks obtained by diluting the condensed milk made from skim-milk to the same consistencies respectively. They blend better with tea, are perfectly soluble, and have neither the sweetness nor the characteristic condensed-milk flavour.

It appears to be the practice with inferior condensed milks to add starch in various forms to give "body." Such additions are fraudulent. They render the milk insipid, and are only the cloak for an impoverished, worthless article—the cupboard, in fact, the skeleton is in.

The best brands of condensed milk in the Colonial market I have found to be quite free from starch. But I admit surprise that in the whole course of my investigations I have met with no sample of condensed milk which, upon analysis, proved to have been made from whole milk. What may be considered the best brand is, clearly enough, merely a by-product of butter-making, a fact which should give encouragement to manufacturing in the Colony, where cows may be grazed more cheaply than in any part of the world.

Though separated milk is inferior to whole milk as a raw material from which to make condensed milk, being devoid of all but a trace of fat, it has, in virtue of this very deficiency, a certain advantage—only from the manufacturer's point of view, however, in producing a more homogeneous material

with a uniform texture or "grain," and it is capable of much rougher handling in the manufacture without injury, though more water has to be taken away, which keeps it longer under treatment. It is possible also that the flavour of such a condensed milk, poor though it is, will keep slightly longer after the tin has been opened, since but little rancid or oily smell is likely to arise from butyric fermentation.

These are points taken advantage of by manufacturers, and upon which they presume they are justified in using separated milk, but they are not warranted in so doing, as a careful test of the sample marked "A" accompanying this report will show. This sample I have made from whole milk containing only 2·8 per cent. of fat. Sample "B" may also be examined as being made from skim-milk containing only a fractional percentage of fat. It will compare favourably with the best brands of condensed milk in the Colonial market.

Microscopic examinations afford valuable supplementary evidence to chemical analyses. They show what condition the fat is in. For if any considerable percentage of the globules have become burst by incompetent management in the manufacture, such as violent and continued ebullition in the vacuum-pan, the condensed milk will be inferior, having an oily smell and taste—a buttery flavour—especially in tea, and being liable to quicker deterioration after the tin has been opened. Keeping qualities must be regarded as an important test, and for this reason evaporation must be carried on without violent ebullition. Further than this, it is perfectly certain that to make the best condensed milk the condensation must be done without ebullition, and at a temperature that will not injure the milk during the time of its condensation, which should, for the same reason, be done as expeditiously as possible.

To secure quick condensation the greatest permissible difference must be maintained between the temperatures of vacuum-pan and condenser. Hence 60° C. should not be deviated from to any considerable extent in either direction for the former, whilst the condenser should be brought down to not quite freezing. Not only will such conditions produce a better article, but they will also reduce the cost of its production. The temperature of 60° C. will cause no deterioration in the quality of the milk during its treatment. It is 10° below the coagulation point of the albumin—not—casein and it involves only a moderate vacuum of about 6 inches of mercury.

As a matter of fact, many of the inferior condensed milks are at present made simply by "boiling to death" a charge of skim-milk and sugar. No special care appears to be taken to avoid coagulation of the albumin—not—casein by regulating the temperature, and the coagulated albumin is continually skimmed off the surface and rejected (or sold as "clotted cream"), thus further impoverishing the already poor separated milk, and very little harm else can be done, as the fat globules are too scarce.

In such cases the milk is first treated in open pans for a time up to the boiling-point, the objects being both to skim and sterilize it; but this is done at the expense of so much of its natural flavour and richness that it is libellous to call the remainder "milk," whilst, on the other hand, it is questionable that it imparts any superior preservative quality at all; and it would be far better, as far as this point is concerned, to depend upon expeditious treatment directly it is received in the perfectly fresh state (or upon other methods of treatment in the case of skim-milk) and the liberal use of the steam-hose in scouring out the apparatus—perfect cleanliness being an indispensable condition for good results. Much will depend on the design of the machinery to afford facilities for this.

The condensation of milk should be carried on at about 60° C. (140° F.) This temperature is as high as may be allowed without injury to the milk, yet it is high enough to secure quick evaporation (without ebullition), and it does not involve difficulties in respect of the vacuum if air-pumps are used for producing it, though if the air be exhausted into a Torricellian vacuum, produced by means of a water column—a system in fact which has been used by Trappe in sugar-making—not the least difficulty need be experienced in this respect; and whichever means of obtaining it is adopted, it will be advantageous in the first production of it to blow through the vacuum-pan over the milk a little low-pressure steam, which will drive the air out, and then condense in the ordinary way in the worm or other form of condenser attached, leaving a vacuum.

The vacuum-pan should be tin-surfaced inside, and be provided with a manometer and a thermometer (preferably centigrade), as for sugar boiling. The best means of heating it would be by a coil of tin-plated copper tube inside, through which either steam or hot water is circulated. The temperature is capable of automatic regulation; so also is the degree of vacuum, and such are advisable both as facilitating the operations for a workman of ordinary intelligence, and preventing ebullition, especially in the condensing of whole milk. In exceptional cases, where an upper floor may be used (or especially where a natural fall of water is available all the year round), the Torricellian principle may be preferable for air exhaustion, as it would not only exhaust but condense by means of the descending water column, and it offers facilities, when arranged in a certain manner, for the exact automatic regulation of the vacuum. The simplest design on this principle would be with the pan about level with the top of the water column, that is, either on an expensive high-level floor (with town supply) or at ground level above a well, the vacuum being maintained by pumping water, which would thus have the additional advantage of coolness for condensing. Even with the above, however, a worm would increase the efficiency. The pan may otherwise be placed near the foot of the water column with an air-pipe back to the vacuum at the top, such air-pipe being attached below, not to the vacuum-pan direct, but to the closed vessel receiving the extracted water, and vacuum being obtained either by water-pumping or by gravity from a town supply.

If the Torricellian vacuum is not used, then the air-pumps are to be attached beyond the condenser to a small closed vessel receiving the extracted water, which is pumped out with the exhaust, other devices being used to regulate the vacuum.

It is important to remark that upon either of the principles now outlined there will be little or no exhausting required, when once the air has been got rid of by blowing through with steam; and the exhausting apparatus need only be of small size, the difference of temperatures between vacuum-pan and condenser controlling all the rest, and the condensing process then practically taking care of itself. These observations have been carefully confirmed by my experiments. A great deal more might be said about the plant, its construction and management, but this will be more appropriate when afterwards it may be proposed to design the same. A complete plant, including principally a vacuum-pan to hold, say, 600 gallons, worm condenser, exhausting appliances, small engine and pump, with tanks, pipes, and fittings, may be estimated at about £500, provided that some existing pattern of simple vacuum-pan could be utilised. Erection and buildings would be extra cost.

During my recent visit to the Clarence River I inspected some vacuum-pans of a type similar to those of many other small sugar-factories lying

idle in the North Coast District. These would be suitable for milk-condensing if they could be purchased without those appendages specially required for sugar-boiling. The steam-engines and air-pumps attached to them, for example, are too elaborate and costly for the requirements of milk-condensing, and the massive condensers might in regard to economy be advantageously replaced by those of the worm form, though their superior efficiency as quick condensers is undeniable, and it would depend solely upon the price at which such plant could be obtained, as a simple vacuum-pan, tin-surfaced, of capacity 600 gallons, to suit the requirements of milk-condensing, could be turned out from the foundry for £180. Such a pan would be rather flatter and afford a larger ratio of evaporation surface for milk-condensing, with the object of securing more steady, yet quick, evaporation without ebullition, this being the ideally perfect system of condensed milk-making.

The milk must enter the vacuum-pan in as fresh a condition as possible, and it is better to make separate condensations of morning and evening milks than to add either fresh milking to the other when half-condensed. In some factories it may be profitable to send one milking to market as fresh milk and to condense the other daily. Condensed milk thickens until two days after tinning, owing to crystallisation of the sugar. Due allowance should be made for this and the milk not condensed too far, which moreover is a chief cause of insolubility of many samples—that is, the albumin is rendered permanently insoluble by such desiccation.

I have noticed that in the process of separating milk a large percentage of the fat globules become ruptured, no doubt by the sudden shock the milk sustains when its inertia is overcome on entering the rapidly-revolving barrel as a continuous feed; and by a microscopic examination I have found that their caseous envelopes remain in crowds in the skim-milk, the contents being emptied into the cream. It is probable that minute quantities of free butter fat remain adhering to these cases in the skim-milk, thus accounting for the somewhat oily taint in condensed milks made therefrom.

Genuine condensed milk made from whole milk will have a dull waxy-yellow translucent appearance, due to the fat, whereas the so-called best brands have more of a chalky whiteness. The amount of sugar need not be so high as 50 per cent., which it often reaches upon analysis. The samples A and B contain only about 33 per cent., but it is quite sufficient for preservative qualities, when only a few sugar crystals are discernible by the microscope. Condensed milk made from skim-milk need not contain so much sugar as that made from whole milk, for it has equivalent preservative qualities in the higher percentage of mineral matters.

Concerning the methods of putting up the article for market, there appear to be no objections to the use of the ordinary tin canisters. The metal has no deleterious effect upon the milk, as is so conspicuously the case with tinned fruit; there should, however, be as little solder inside as possible, and with proper manufacture and care in storing, the tins will not burst. If glass or porcelain jars are used, paraffin and then paraffin-soaked parchment paper are the best covering. Much is to be said in favour of glass jars thus covered; first, because the paraffin, when run on, sets down right in contact with the surface of the milk, sealing it hermetically, and imparting no taint; and, secondly, people can see the article before they buy it. Users should be advised on the labels that in mixing condensed milk they should use only the purest water that has been boiled and then filtered.

In conclusion, I may appropriately remark that my report contains nothing which is not the result of my own direct observation and experiment.

Orchard Manures.*

By ALBERT H. BENSON,
Fruit Expert.

THERE is no branch of the science of horticulture that is of more importance to the fruit-grower who wishes to make fruit-growing a commercial success, than a thorough knowledge of how best to obtain and apply the various plant-foods required for the proper development of the different varieties of fruits, so as to produce the best results with the least expense. In order to obtain this knowledge it is necessary in the first place to study the requirements of plant-life with the view of ascertaining—firstly, what plants are made of; secondly, how they obtain and assimilate their food; and thirdly, what foods are essential to their proper development; as without this knowledge it is impossible to know what manures to apply, how to apply them, and when to apply them.

Before, therefore, going into the details of the various manures, I think it will be as well if I say a few words on the physiology of plants in general, so as to show how they live and grow, and what plant-foods they require.

1st. What Plants are made of.

All matter is divided into two great classes—organic and inorganic. Organic matter is that portion of plants or animals which is combustible, and and which on being burnt passes away in the form of invisible gases. The portion remaining after the plant or animal has been burnt is the inorganic matter, and this forms what is spoken of as the ash. In plants the organic matter constitutes by far the greater amount of the whole plant, varying from about 92 per cent. of the total weight to as high as 99½ per cent. of the total weight, and it consists almost entirely of the following four elements:—Oxygen, hydrogen, carbon, and nitrogen, and smaller quantities of sulphur, and possibly phosphorus.

The first two of these substances unite in the proportion of two parts of hydrogen with one part of oxygen to form water, which is the most abundant ingredient of all plants, in fact, in the case of turnips ranging from 86 to as much as 93 per cent. of the total weight of the plant when fresh.

Five parts of water unite with six parts of carbon to form cellulose, which is the substance of which the main framework of all plants is made. All agricultural plants and trees are composed, or rather built up, of an aggregate of microscopic cells, and the walls of these cells are composed of cellulose, which, next to water, is the most common substance in the vegetable world. Water also unites with carbon in the proportion of six parts of carbon to five, six, or eleven parts of water to form the great class of what are termed

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carbo-hydrates, under which heading, cellulose, the different starches, gums, and sugars which are found in plants are placed. All oils found in plants are also composed of these three elements, but in different proportions to the carbo-hydrates, as also are the fatty acids and several other complex substances found in plants.

There are in addition other classes of organic substances found in plants, of which the alkaloids (which contain nitrogen in addition to the carbon, hydrogen, and oxygen) and the albuminoids, which contain in addition a little sulphur, and from 15 to 18 per cent. of nitrogen, are the principal. This list contains practically all the organic constituents of plants, so I will now deal with the inorganic or ash constituents, and here we find that in addition to the oxygen, carbon, and sulphur, that were present in organic matter, we have in addition the following elements:—Phosphorus, silicon, chlorine, potassium, sodium, calcium, magnesium, iron, manganese, which, if we add the nitrogen and hydrogen present in the organic compounds, makes up the list of elements that are necessary to the proper development of plant-life. Of these elements, several occur in sufficient quantities in most soils, as the amount required by plants is only small, but there are others: phosphorus, potassium, nitrogen, calcium, and iron, which, if not existing in the soil in sufficient quantities, must be added to the soil in the form of a manure before the soil can become fertile, as the fertility of a soil is judged by the amount of either of these, so to speak, essential elements, that is present in the smallest quantity, as, no matter how rich a soil may be in every other ingredient, if one is deficient, the soil will not grow crops satisfactorily till the deficiency is made good.

2nd. How Plants obtain and assimilate their Food.

Plants consist of three main parts—roots, branches, and leaves. The leaves are the lungs of the plant, and have on their under surface innumerable small openings or mouths, which are open during the day and closed at night, and through which the plant breaths, and it is by means of these mouths that plants obtain direct from the atmosphere the whole of the carbon required to build up the tissue of the plant, and to form the various carbo-hydrates, such as starch, sugar, &c. In the atmosphere there is always present about 4 parts in 10,000 of a heavy gas, known as carbon di-oxide, which consists of one part of carbon and two parts of oxygen, and this gas is absorbed by the leaves of the plant through the mouths, and the plant has the power of breaking it up into its component parts. The carbon it retains and assimilates, converting it in conjunction with water first into cellulose, and a part of the cellulose is further converted into the various carbo-hydrates found in plants, and the oxygen it returns to the atmosphere. Small as the percentage of carbon di-oxide in the air appears to be, it is, nevertheless, several times greater than that required by any crop, and, although it is always being used during daylight by all plants, there is no diminution in the amount, as the supply is being constantly renewed by means of fires of all kinds, and by the exhalations of all animals. Plants are distinguished from animals by this means, as plants inhale carbon di-oxide, and exhale oxygen, and animals inhale oxygen and exhale carbon di-oxide, and thus the amount of carbon di-oxide in the atmosphere remains stable. Nitrogen, though it constitutes about four-fifths of the atmosphere, cannot in most cases be obtained by plants directly from this source, though leguminous plants have a power to assimilate nitrogen, probably from the air that is contained in the water that is taken up by the plant by means of its roots.

It is their power of assimilating nitrogen that renders certain varieties of leguminous plants, such as vetches and cow peas, of such value for green crop manuring, as it is the cheapest way of supplying a soil with nitrogen, and, where the soil is deficient in organic matter as well, it is one of the cheapest and most effective methods of manuring. The oxygen and hydrogen required by the plant are obtained from the water that is taken up by the roots, and which is absolutely necessary for the plant's existence, and all the other elements that enter into the composition of the plant, are obtained in a soluble form that is dissolved in the water that is taken up by the roots. No insoluble or solid matter can be taken up by the roots, everything must be in solution in water. Water alone is often unable to dissolve the ingredients required by plants, and which are present in the soil in an insoluble form, but water containing air and carbon di-oxide acts on the insoluble matter present in the soil, and slowly renders the insoluble matter soluble, and so available for plant-food. Stagnant water has not this power, hence one of the great advantages of draining soils, which I mentioned in my last lecture, is plainly shown, namely, that the aeration of the soil which follows the removal of the stagnant water assists disintegration, as it supplies the necessary air and carbon di-oxide to the water, to enable it to act on the insoluble matter of the soil, and render it soluble and available for plant-food.

3rd. What foods are essential to the proper development of Plants.

As I have previously mentioned under the heading of "What plants are made of," the following elements are generally considered to be essential to the proper development of all cultivated plants, viz.:—Oxygen, hydrogen, carbon, sulphur, silicon, chlorine, sodium, manganese, magnesium, iron, calcium (lime), potassium, phosphorus, and nitrogen. Of these, the first two are always in a readily available form in water, and carbon is always present in the air in sufficient quantity, so no further notice need be taken of these three. The next six elements in the list are, as a rule, present in all soils in sufficient quantity for the growth of all crops, excepting in certain cases, magnesium, which forms about 17 per cent. of the ash of almonds, and about 13 per cent. of the ash of quinces. It is not necessary to apply magnesium as a manure by itself, as if the land is limed there is enough magnesium mixed with the lime to supply all requirements. This reduces the list to five, and of these five, one, viz., iron, is usually present in sufficient quantity in most soils, but some of our poor sandy soils, such as those of the George's River, have been found deficient in this ingredient, and very beneficial results have followed its application as a manure. Iron is present in the soil in two forms—a ferrous form, which, when it is present in too great a proportion (over 1 per cent.) renders the soil valueless, as it is injurious to vegetation. When iron is present in the soil in this form in excessive quantities the remedy is to drain the soil, thereby aerating the soil and exposing the ferrous salts to the air, when they are rapidly oxidised and converted into ferric oxide, or, as it is commonly known, iron-rust. Lime applied to the soil has a similar effect in this case to draining. The other form of iron present in the soil is the ferric oxide, or iron-rust, to which the red colour of soils is due, and it is in this state that it is taken up by plants, dissolved in water. Iron is essential to the formation of the green colouring matter, or chlorophyll, of the leaf, and its absence in the soil is shown by the sickly or blanched appearance of the foliage. Should iron be found to be deficient in the soil

it is best applied in the form of ferrous sulphate (copperas or green vitriol), which is readily converted by the action of the air into iron-rust, and is then available when dissolved in water for plant-food. The amount of copperas required will rarely exceed 1 cwt. per acre; in fact, more would probably do harm, and it is best applied in the early spring, just before the active growth of the tree takes place. Copperas, in addition to its manurial value, has also often a beneficial effect on the trees to which it is applied, as in the case of peaches it often proves of value as a preventative of the curl leaf and also of the peach rust, which causes the tree to lose its leaves prematurely. It is possibly also of value in preventing the spread of other fungus diseases by stimulating a strong and vigorous leaf-growth, thereby enabling the tree to resist their attacks to a certain degree. The other four elements—calcium (lime), potassium, phosphorus, and nitrogen—are those to which the fruit-grower has practically to confine himself in determining what manures are best adapted to the growth of the different varieties of fruits, as they are the ingredients in which soils become most rapidly exhausted, as they form by far the greater portion of the ash of all cultivated plants. They are all absolutely essential to plant growth, and when either of them is present in the soil in an insufficient quantity, either due to the natural poverty of the soil or to its impoverishment through cropping, the deficiency must be made good by the application of the necessary manure before the soil can be made to produce a satisfactory return. In treating of orchard manures, I will, therefore, confine my remarks to these four elements, and will endeavour to show as briefly as possible the proportions of each that are extracted from the soil by different fruits—what manures are required to supply them, and how and when it is best to apply these manures.

Before, however, taking up these individual elements in detail, I may state that the proportions given of each ingredient that is required by the different varieties of fruits are, at the best, only approximations, and are liable to change, according to the soil in which the fruit is grown, and also to the conditions under which it is grown; and also that they are compiled from European and Californian analyses, which are sure to vary more or less from Australian ones. Unfortunately, no analyses of Australian-grown fruits have been made, and until a complete series has been made it is impossible to speak with any degree of exactitude.

Calcium (Lime).

Lime is essential to the growth of all plants, and constitutes from about 4 per cent. of the total ash in the case of the apple, to as high as 30 per cent. in the ash of Californian lemons—the orange requiring rather less, about 23 per cent. These percentages refer to the fruit itself, but the wood of some of our fruit-trees, notably the olive, contains a very much greater proportion, for, whereas the proportion of lime in the fruit of the olive is only about 16 per cent. of the total ash, that of the wood is about 60 per cent. Most of our soils contain lime in sufficient quantity for all crops, but there are others again in which there is a marked deficiency. Where these latter occur lime must be applied as a manure, and for this purpose from 1 ton to 1½ tons per acre is sufficient, but if, in addition to the soil being deficient in lime, it is sour and unworkable, a much larger amount—from 4 to 6 tons to the acre—must be applied. Lime owes its efficiency, not only to its value as a manure, but more especially to the effect it has on the soil of sweetening it, and rendering it more friable, and consequently more easily worked; and

in addition it acts beneficially in that it renders a portion of the unavailable potash of the soil available for plant-food. It also acts on the injurious salts of iron present in the soil—oxidises them, converting them into iron-rust, which, except when it is present in the soil in any excessive quantities, is not injurious to vegetation. Its sweetening effect is due to the fact that when it comes in contact with the free acids in the soil it neutralises them. If the lime is required by the soil to supply its natural deficiency it may be applied in the form of chalk—ground shells, or coral, or any other form of carbonate of lime—or as caustic lime, formed by the burning of any form of carbonate of lime, but if its mechanical, rather than its manurial, qualities are required, then it should always be applied in the caustic form—that is, the unslacked lime direct from the kiln, as its effects are then far greater. Lime is best applied during the autumn or winter, and it should be evenly distributed over the land, and lightly ploughed in. If ploughed in too deeply a quantity is sure to be lost, as it always tends to sink in the soil. Lime should always be used by itself, as if used in conjunction with other manure it will cause the whole of the nitrogen present in the manure to be thrown off in the form of ammonia gas, and so become lost. Where the land is regularly manured with bone-dust or superphosphates, there is always enough lime present in these manures to meet the requirements of any crop without special recourse being had to liming by itself, but where the soil is naturally deficient in lime, a first manuring of lime should be given, and then subsequent manurings of bones or superphosphates will generally suffice without any further applications. Lime is obtained by plants in the form of carbonate which is dissolved by water containing carbon di-oxide in solution, and is thus absorbed by the roots.

Potassium (Potash).

Potash is also an essential ingredient of the ash of all plants, and in the case of most fruits it may be said to be the most important ingredient, as it forms by far the largest proportion of any ingredient present in the ash of fruits, as will be readily seen by reference to the following figures, which show the total ash contained in 1,000 lb. of each of the following fruits, and also the amount and percentage of potash present in the ash :—

	Total ash.			Percentage of potash.
European.—Grapes ...	8·8 lb.,	containing potash,	5 lb.	56·8
Californian.—Apricots	5·16 ,,	,,	2·16 ,,	41·8
European.—Prunes ...	6·3 ,,	,,	3·73 ,,	59·2
Californian.—Prunes ...	4·03 ,,	,,	2·65 ,,	65·7
European.—Oranges ...	6·07 ,,	,,	2·78 ,,	45·8
Californian.—Oranges..	4·32 ,,	,,	2·11 ,,	48·8
European.—Pears ...	3·3 ,,	,,	1·80 ,,	54·8
European.—Plums ...	2·9 ,,	,,	1·72 ,,	59·6
European.—Apples ...	2·2 ,,	,,	0·80 ,,	36·4
Californian.—Lemons..	5·57 ,,	,,	2·69 ,,	48·3
Californian.—Figs ...	7·81 ,,	,,	4·69 ,,	60·0
European.—Cherries ...	3·9 ,,	,,	2·0 ,,	51·3

For peaches, nectarines, quinces, and other varieties of fruits, I have been unable to obtain definite analyses, but in the case of peaches and nectarines the percentage of potash is high. At any rate the list I have given is sufficient to show the importance of potash for fruit-growing, and the necessity for its application to soils that it is deficient in. It is curious to note from the figures I have given what a difference there is in the quantity of potash present in the European and Californian fruit, the percentage of potash always predominating in the latter, but the predominance is probably due to

the fact that nearly all Californian soils are exceedingly rich in potash. The difference between the European and Californian analyses shows us the necessity I previously mentioned of having a complete series of analyses of Australian fruits. Many of the soils of this Colony are deficient in potash, especially those of sandstone formation, but most soils of volcanic, granitic, or basaltic origin are fairly rich in potash, some being even very rich. The clays and clay loams of Cumberland, which are formed from the Wianamatta shales, have a fair amount of potash, and this is one of the reasons that fruit has been successfully grown on these soils for a number of years without the application of special potash manures, simply by the use of bone-meal, to supply the requisite phosphoric acid and nitrogen in which the soil is deficient. Now, however, through the continual cropping of the land for a number of years without replacing any potash, many of our older orchards are becoming deficient in this respect, and would be greatly benefited by the application of special potash manures, or, even if there is still plenty of potash remaining in the soil, by the application of lime to free this potash and render it available for plant-food, as it is probably present in a more or less unavailable form. There are three great sources of potash—first, granite, the bed-rock of the world, from which all other rocks have been originally either directly or indirectly formed, and from whence the supply of potash in all soils has been derived indirectly. Granite consists of quartz, felspar, and mica, and it is the felspar, of which there are several varieties, that contains the potash, one variety (orthoclase) containing as much as 16 per cent. The second great source of potash is salt water, which contains about 7·6 lb. of potassium chloride in 10,000 lb. of sea water, so that the supply from this source alone is inexhaustible. The third great source, and the one from which we obtain our supply, is the great deposit of potassium salts that are found near Strassfurt, in Germany, where the supply is enormous. From the crude salts we obtain kainit, which is largely used as a manure, and which contains, in good samples, about 25 per cent. of sulphate of potash, which is equivalent to about 12½ per cent. of potash (K_2O), the value of which at present prices is 6s. per unit. That is to say, a manure containing 1 per cent. of potash is worth 6s. per ton, and a manure containing 10 per cent. of potash is worth 60s. per ton. In addition to the kainit, sulphate of potash is now available at a very moderate rate, and practically pure. Pure sulphate of potash contains 54 per cent. of potash, and the sample quoted in the analyses of commercial fertilisers published by the Department of Agriculture contains 52·376 per cent. of potash, or, roughly speaking, only 1½ per cent. of impurities. There are two other forms of potash on the market, chloride of potash and nitrate of potash, but where the sulphate can be obtained it is the preferable form to use, as the chloride is not as desirable salt to use in many soils, and the nitrate is too dear. The ashes of many trees are also rich in potash, but only when they are grown on soils containing a sufficient supply of potash. The ash of trees growing on poor sandstone soils seldom contains much potash, and is often of little value as a manure. When used in conjunction with other manures, which is in many cases desirable, sulphate of potash should be used. Also when the question of railway carriage or long cartage is to be considered, it is preferable to kainit, as it only takes one-fourth the amount.

Sulphate of potash is most beneficial when applied to the trees early in spring, just as they are starting into growth, as being in a soluble form, it is readily assimilated by the tree. If the soil is of a very open porous nature, it is better to apply the manure in two or three dressings at intervals rather than all at once, as if applied all at once and heavy rains set in a considerable

portion will be leached out of the soil and lost. This applies equally when soluble phosphatic or nitrogenous manures are applied to light porous soils.

From 1 cwt. to 2 cwt. per acre of sulphate of potash is about the quantity required to produce a good crop of grapes, plums, and prunes, and though oranges and lemons contain rather less potash in proportion than these fruits, yet the much larger weight of fruit produced in good bearing orchards more than makes up for the deficiency, and the call on the potash is often as great, if not greater, than these fruits, prunes excepted. If kainit is used in the place of sulphate of potash, from 6 to 8 cwt. per acre will be necessary. In most cases potash-manures are most advantageously applied in conjunction with phosphatic and nitrogenous manures, as few soils simply require potash without the other ingredients. For the first few years the manure is best applied broadcast round the roots of the tree and harrowed in, the proportion applied to the tree increasing yearly; but when the trees grow older the manure should be evenly distributed all over the orchard, as, if placed directly round the trees, it will confine the roots to that part, and should a dry time come the tree will soon suffer from drought through its not having enough feeding ground, the roots completely exhausting the moisture from the part of the ground into which they are crowded. For young trees the amount of manure required in a poor soil will be about 4 lb. per tree the first season, 6 lb. the second, 8 lb. the third, 10 lb. the fourth, and for all the fruits I have mentioned if the soil is deficient in potash the manure used should contain not less than 4 cwt. of sulphate of potash to the ton of manure—the balance consisting of about 6 cwt. of superphosphate, 9 cwt. of good, pure, bone-meal containing not less than 3 per cent. of nitrogen, and 1 cwt. of sulphate of ammonia, which at present prices would cost about £7 per ton. If wished, 2 cwt. of dried blood may be used in the place of the 1 cwt. of sulphate of ammonia, and in order not to exceed the ton, 8 cwt. in the place of 9 cwt. of bone-meal. A manure such as I have mentioned would contain all the elements of plant-life that it is necessary to supply by manuring, to most soils, and in such a form that a portion would be immediately available as plant-food, and the balance would only become slowly available as required by the plant. This is one of the great secrets of successful manuring, viz, so to supply your manures that the tree or plant has always a sufficient amount of plant-food of all kinds available, and not a great feed to-day and then a starve of a week before it gets any more. This is not the way one would treat a horse or a man if one wanted to get good work out of him, neither is it the way to treat a fruit-tree if you want to make manuring pay and fruit-growing a success.

Phosphorus.

As the result of a very large number of analyses of soils from all parts of this Colony, it is found that phosphoric acid is the material in which they are, as a whole, most deficient; and yet, notwithstanding this, we are sending a very large amount out of the Colony yearly in the form of bones and boiling-down refuse, and for what purpose? Why, to supply the New Zealand farmer with the material wherewith to grow crops to produce the cross-bred mutton for exporting to England, and so close the market to the New South Wales product. Phosphorus, or as it is generally spoken of in manuring, phosphoric acid, is essential to the growth of all fruits, occurring in the seeds in far larger amounts relatively than in the flesh, in which respect it is similar to nitrogen. It is owing to this that the thinning of stone fruits has such a beneficial effect on the tree, in addition to the mere increase in size of the fruit allowed to remain. As when a peach or an apricot is allowed

to bear an excessive number of small fruits, the crop, besides being comparatively worthless, will have so weakened the tree, and made such a call on the soil, that it will take a year's rest to recuperate, whereas where judicious thinning is practised, the tree will produce annually a greater weight of first-class fruit that will do less damage to the tree and soil than the great number of small worthless fruit, and the great crop of stones.

Phosphoric acid is derived principally from the following sources:—Bones, phosphatic guanos, coprolites, and basic slag. As far as this Colony is concerned, bones are practically the only source to be considered, though basic slag is proving a cheap source. Bones may be either applied in the form of bone-meal, when the phosphoric acid contained in them is combined with lime in an insoluble form that is only slowly available for plant-food by being rendered soluble by the carbon di-oxide in the water of the soil, or they may be applied in the form of superphosphate, when the phosphoric acid is in a soluble and readily available form for plant-food.

Superphosphate is formed by the action of sulphuric acid (oil of vitriol) on bones, or any other form of insoluble phosphate, converting the insoluble into soluble phosphates. The relative value of these two forms of phosphoric acid is estimated at 3s. per unit for the insoluble, and 6s. 3d. per unit for the soluble. Where a rapid growth and a quick return is required, as in the case of vegetables, the soluble form should be used, but where a lasting effect is required, use the insoluble. In the case of fruit-trees the two forms are best used together, so as to produce the best effects, as the soluble phosphates stimulate a rapid growth, and when their effect is past the trees have the more lasting form to fall back on. It is often a good plan to apply the insoluble form during the autumn, so that it may become slowly acted on in the soil, and be ready for the plant-growth in spring; but the soluble form, or superphosphates, should never be applied except at a time that the plant can absorb them—that is to say, during a period of active growth.

The following are approximate percentages of the amount of phosphoric acid in the ash of the following fruits compiled from the same sources as those given in the case of potash.

Grapes (European) 17·3	Apricots (Cal.) 13·7	Cherries (Eu.) 15·4
Prunes (Cal.) 13·1	Oranges (Eu.) 11	Prunes (Eu.) 15
Pears (Eu.) 15	Plum (Eu.) 15	Oranges (Cal.) 12·3
Figs (Cal.) 11	Lemons (Cal.) 10·9	Apples (Eu.) 13·6

The quantity of phosphoric acid removed by 1,000 lb. of each of these fruits is shown in the table at the end. The Californian and European analyses are much more nearly alike in the percentages of phosphates than was the case with the potash. As will be seen by reference to the table mentioned the weights of phosphoric acid removed from the soil and contained in the ash vary considerably in the same weight of different fruits, for whereas 1,000 lb. of grapes removes 1·52 lb., the same weight of apples only removes ·3 of a lb. On comparing the amounts of phosphoric acid with those of the potash in equal weights of the same fruit, it will be noted that the percentage of potash is usually at least three times as great as that of phosphoric acid, which shows the necessity of using potash in conjunction with phosphoric acid as a manure for fruit-trees in all soils except those that are rich in available potash. In order to show in as clear a form as possible the amounts of potash, phosphoric acid, and nitrogen that are removed by the different varieties of fruits and the necessary amount of manure that is required by each to produce a good crop, I have attached to the end of this paper a tabulated statement showing first the amounts of each of these ingredients contained in the ash of 1,000 lb. of different

varieties of fruits; secondly, the amount of each that is taken from the soil by a good crop; and, thirdly, the amount of sulphate of potash required to supply the necessary potash, the amount of phosphates required to supply the phosphoric acid, and the amount of sulphate of ammonia required to supply the nitrogen; and if other manures are used in the place of these mentioned it is a simple question of a little figuring to determine the amount necessary if their analysis is known.

Nitrogen.

We now come to the last of the essential plant-foods that we have to consider, and, though last, by no means the least important or least expensive to supply to the soil when it is present in a deficient amount, for though, as I mentioned previously, about four-fifths of the air consists of nitrogen, still it is not available for plant food, except in the case of certain varieties of leguminous plants. In fact, it is the most expensive element we have to supply to the soil, its value at the present time being about 13s. per unit. Nitrogen occurs in all plants, and is absolutely essential to their proper development. It occurs principally in the albuminous matter of fruits, of which it forms about one-sixth, and by far the greater portion of the albuminous matter of fruits is contained in the seeds or kernels, and not in the flesh, hence the value of thinning, as previously pointed out, as by judicious thinning you produce as large an amount of flesh and as small an amount of seeds (stones) as possible, thereby greatly reducing the amount of nitrogen required. Nitrogen occurs in the soil in the form of nitrates which are found in conjunction with the organic matter of the soil, which has the power of converting ammonia, the form in which nitrogen is usually applied to the soil, into nitric acid, which forms in conjunction with the potash and soda, &c., in the soil what are termed nitrates, and these nitrates are taken up by the tree and assimilated.

There are many sources of nitrogen, but of these only two may be considered as of paramount importance in New South Wales, viz., sulphate of ammonia and dried blood. Nitrogen may also be obtained in the form of nitrate of soda and nitrate of potash, which, though they are more readily available as plant-food than sulphate of ammonia, as they have not to undergo the process of nitrification, are still too dear when compared with sulphate of ammonia to be used extensively. Nitrogen also occurs in smaller proportions in many substances that are used as manures, and of these guano, especially Peruvian guano, was at one time the great source of the supply of nitrogen, but the deposits are now pretty well played out, and are of more value for the phosphates than the nitrogen they contain. Bone-meal also contains from 2 to 4 per cent. of nitrogen, the amount depending on the amount of gluey matter that is mixed with the bones proper; and fowl manure, stable manure, the droppings of all animals, especially sheep, night-soil refuse, skin, and hair, and several other ingredients, contain a small proportion of nitrogen, and are valuable as manures. But as I mentioned at first these are two main sources of supply—sulphate of ammonia and dried blood. Sulphate of ammonia is obtained as a waste product from the gas-works, and though costing £13 per ton, it is the cheapest form in which nitrogen can be supplied to the land. Sulphate of ammonia acts very rapidly on any trees or plants to which it is applied, producing a vigorous growth, and imparting a dark-green, healthy colour to the foliage. It should never be applied except when the tree is in active growth, as, on account of its solubility, if applied at any other time, it is apt to be washed out of the soil, especially if the soil is of a porous nature, when it is always advisable

to apply it to the trees at two or three dressings rather than all at once. Sulphate of ammonia is an exceedingly stimulating manure, and it has the power of forcing the soil—that is to say, it produces a very vigorous leaf growth, which, in its turn, makes a very greatly increased call on the roots, which again take from the soil an increased amount of plant-food, so that it is not advisable to use sulphate of ammonia unless you feed your soil with the necessary potash and phosphoric acid required by the tree. Used alone it will so impoverish your soil that finally it will produce nothing, a result that I have noted when in Scotland, where, through the continual manuring of the soil with nitrate of sodà, the action of which is similar to sulphate of ammonia; and by its use forcing big crops, which were sold off the land. I have seen soils completely played out, and that took years of careful, cropping and manuring to bring them into fair heart. Used judiciously, sulphate of ammonia is one of the best manures that can be applied to an orchard, especially if the trees are a bit sickly and off, when, if the roots are sound, and the trees are not showing badly through want of drainage, they may be brought round into vigorous health, provided, when they are started, that other manures are available from which the trees may obtain the necessary food wherewith to maintain their increased growth.

In dried blood the nitrogen is not in as readily available a form as in the sulphate of ammonia, as it is present in the form of albuminous matter, which has to be converted first into ammonia, and then into nitrates, before it can be used by plants. Its action is thus much more lasting than that of sulphate of ammonia, as it continues to supply nitrogen to the plant for a considerable time. Thus, sulphate of ammonia should be used in conjunction with the soluble phosphates and potash to start the growth, and dried blood used in conjunction with bone-meal or other slowly available phosphate be used to supply the plant-food when the more readily available and soluble foods have become exhausted. Before I conclude speaking about nitrogenous manures there is one point I should like to call attention to, and that is, that many substances, such as refuse skin, hair, and leather, though containing often a considerable amount of nitrogen, as shown by analysis, are yet of very little value for manure, and this is due to the fact that the nitrogen is in a very unavailable form, and only becomes available very slowly in the soil.

There is one other very cheap and efficient way of applying nitrogen to the soil, and it is the one that is given least attention to, viz., green manuring. As I have already mentioned, leguminous plants have the power of assimilating nitrogen from the air and of storing it up, so that if these plants be sown in the orchard, and ploughed in when they contain the most manurial matter, which is just before the pod ripens, the soil will be enriched by the amount of the nitrogen that has been obtained by the plants from the air. Green manuring has also another very beneficial effect, especially on heavy soils, as by the addition of the organic matter they become more friable, and consequently more easily worked, and the addition of organic matter to the soil, besides supplying soils that are deficient in this respect, has the further effect of enabling the soil to retain more moisture, and so withstand drought better. The percentage of nitrogen required by different fruits is shown in the table at the end of this paper, from which it will be seen that the amounts required by different fruits vary considerably, as whereas 10 tons (2,000 lb. to ton) of oranges require 53·8 lb. of nitrogen, the same amount of pears and apples only require 12 lb. of nitrogen.

I have now endeavoured to show which of the elements are essential to plant life, and how such of these elements as may be deficient in the soil

may be most easily and economically applied, but there are several sources of supply that I have not mentioned, and as to which I will say a few words before I conclude, as in the case of many of our orchardists and farmers, they are entirely neglected, or only so carelessly looked after that they are of little value.

The first and most important source that I have not mentioned is the ordinary stable or farm-yard manure, which consists of more or less straw, or other material used as litter, combined with the urine and dung of our domestic animals. When properly taken care of, and kept from the rain to prevent leaching, farm-yard manure contains within itself all the elements necessary to plant life, and where produced on an extensive scale, as is the case where cattle are housed during the winter, it still forms the basis of all manuring. In addition to its manurial value, it has also a very beneficial effect in improving the mechanical condition of heavy soils, and of supplying them with organic matter; but, against this, it has the great drawback when used for orchard purposes, of being the means of introducing such weeds as sorrel into the land, and also on account of the large quantity that it is necessary to apply per acre in order to obtain the necessary manurial matter, it is much more expensive to apply than the manures I have previously mentioned. However, all that is made at the orchard should be taken care of, and if not applied to the orchard for fear of bringing weeds, it should be spread over the grass paddock in winter or early spring, after having been allowed to become thoroughly rotten, when its effects will soon be shown in the improvement in the quantity and quality of the grass. All weeds and other refuse material, such as leaves, instead of being burnt, should be made into compost heaps, either with or without lime, and used when required. The addition of the lime will cause the heap to rot quicker, but all the nitrogen will be lost. All the fowl manure and night-soil should also be used instead of allowing it to go to waste. The night-soil should be mixed with dry soil, charcoal, or ashes, either wood or coal, but when ashes are used the nitrogen is lost. When used in this manner it may be placed round the trees with very beneficial results; in fact, in two orchards that I have visited in different parts of the Colony, very satisfactory results indeed have followed the application of night-soil on an extensive scale.

Fresh Fruits.	Total Ash in 1,000 lb. of Fruit.	Potash (K_2O) in 1,000 lb.	Estimated weight of Crop.‡	Potash in Crop.	Sulphate of Potash (50 % K_2O) required.	Phosphoric Acid (P_2O_5) in 1,000 lb.	Phosphoric Acid in Crop.	Superphosphates (18 % P_2O_5) required.	Nitrogen in 1,000 lb.	Nitrogen in Crop.	Sulphate of Ammonia (20 % N) required.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Grapes (Eu.)*	8·8	5·00	10·000	50	100	1·52	15·2	84·5	1·7	17	85
Apricots (Cal.) † ..	5·16	2·16	20·000	43·2	86·4	·71	14·2	79	2·29	45·8	229
Prunes (Eu.)	6·3	3·73	30·000	111·9	223·8	·95	28·5	158·3	1·22	36·6	183
Prunes (Cal.)	4·03	2·65	30·000	79·5	159	·53	15·9	88·3	1·48	44·4	222
Oranges (Eu.)	6·07	2·78	25 000	69·5	139	·67	16·75	93	2·69	67·25	336·25
Oranges (Cal.) ..	4·32	2·11	25 000	52·75	105·5	·53	13·25	73·6	1·83	45·75	227·75
Lemons (Cal.)	5·57	2·69	25·000	67·25	134·5	·61	15·25	84·2	1·51	37·25	186·25
Pears (Eu.)	8·3	1·80	20·000	36	72	·50	10	55·5	60	12	60
Apples (Eu.)	2·2	·80	20·000	16	32	·30	6	33·3	·60	12	60
Plums (Eu.)	2·9	1·72	20·000	34·4	68·8	·44	8·8	49	4·20	84	420
Olives (Cal.)	14·22	8·5	5·000	42·5	85	1·18	5·9	32·8	17	85	425
Figs (Cal.)	7·81	4·69	20·000	93·8	187·6	·86	17·2	95·6	2·38	47·6	238
Cherries (Eu.) ..	3·9	2	8·000	16	32	·6	4·8	26·7	..	..	....

* (Eu.) means that the amounts given have been calculated from European analyses.
† (Cal.) means that the amounts given have been calculated from Californian analyses.
‡ Is only an intimation of a probable crop under favourable conditions—and not to be taken in any way as a standard. Of course knowing the amount of the potash, phosphoric acid, and nitrogen removed by 1,000 lb. of any fruit, it is an easy matter to calculate the amount removed by any given weight of fruit.

Poultry.

By S. GRAY,
Sub-Editor.

Seasonable Notes.

It may be reasonably supposed that poultry-keepers will desire to do everything in their power to keep their stock in health and comfort, and that even those who take no interest in them beyond that of pure and simple business will make a slight effort to secure the best returns. The hot weather, which is now upon us, calls for many attentions, small in themselves, but of infinite importance if health, comfort, and financial success are desired in and from the poultry-yard.

There is nothing more common than to see the drinking utensils so placed that the sun plays directly on the water. Sunned water is a serious cause of disease amongst poultry, and has been proved to account for many apparently unexplained deaths. It is absolutely necessary that the drinking water should be placed in some shady place—a position which is always in the shade. Even if there is no bush which answers this description, four sticks and a small sheet of bark may be readily made to answer all requirements. As in the case of human beings fowls occasionally suffer in hot weather from a feeling of lassitude. This may, to a certain extent, be counteracted by putting a little solution of sulphate of iron in the drinking water, say, a teaspoonful to every twelve birds. This tonic will also be beneficial in respect to looseness of the bowels which usually follows the drinking of sunned water. Another important point is to see that the water given to poultry is always fresh, and that plenty of it be provided. Abundance has the effect of moderating the quantity taken by the birds. When any drinking utensil is allowed to remain dry for any length of time and is then filled up the birds cluster round it to drink, and, being very thirsty, are apt to take more than is good for them.

Then as to the feeding. Here, again, we may proceed on a common sense basis. I am aware that some of our friends in the country vary their meals very little, even in the hot weather, but I think they will admit that they do not eat them with that relish which characterises the eating of a hot meal on a cold winter's day. For this reason food of a heavy, heating, character should in warm weather be discarded in favour of something lighter. Maize should be replaced by wheat with occasionally a few good sound oats. Fresh green vegetables should be given at least once a day. At this time of the year insects are fairly plentiful, so that a meat ration is not so necessary, but unless the birds have free range a little chopped meat must not be forgotten.

The time will shortly be coming round for the annual invasion of ground crickets. I am aware that many orchardists differ from me, but I have satisfied myself from careful inquiry amongst less conservative fruit-growers

that allowing the young birds free range of the orchard is of great benefit, not only in keeping down crickets, but other insects as well. The very small amount of damage they may do to the trees, which I hold is infinitesimal, is certainly more than compensated by the manurial value of their droppings, while the benefit they confer on the orchard in reducing the number of predatory insects is all to the good. I will go so far as to say that even where peas are growing between the trees, the good work performed by a small flock of fowls quite balances any damage they do to the pea crop. In addition to the fowls a few Turkey poults and young ducks will be found of great service during the cricket invasion. During this period I have found it of great advantage to allow a few sheets of bark, iron, or other available shelter to lie about the orchard. The cricket will promptly get under the cover so provided, and periodical visits to turn these covers over, in company with the poultry, which will soon learn to follow, will lead to a very large destruction of these pests. It may be mentioned that young birds fatten very quickly on such diet, so that the system will be found doubly advantageous.

If the poultry houses have not been kept scrupulously clean, lice will now be abundant. The first thing to do under such circumstances is to smother the inside of the house, after removing perches, nest-boxes, and any other impedimenta, with a mixture of kerosene and soft soap by means of a spray-pump. The nest-boxes and perches should also be thoroughly swabbed over. Having by this means killed all the lice, lime-whiten thoroughly every portion of the house and everything used by the birds. It is a good plan to place little pieces of camphor at the bottom of the nest-boxes. It must always be borne in mind that lice interfere seriously with the comfort of the birds, and while they are present, satisfactory results are impossible.

While on the subject of roosting-houses, a very good suggestion comes from an American breeder. He has no fixed perches in his houses. Enough perching space is provided in each pen by means of movable trestles. These can be made of a height to suit any kind of bird, and are simply removed whenever the house is being cleaned, which, at this time of the year, should be at least once a week.

Sufficient care does not appear to be taken of poultry droppings. On being removed from the pens they should be mixed with double their quantity of ordinary soil, and kept in a convenient place a few weeks before using. This mixture forms a strong and easily applied manure for the kitchen garden. Another means of applying them is in the form of liquid manure, in which form they are very valuable for vegetables.

Practical Vegetable Growing.

Directions for the Month of January.

Attention cannot be too frequently directed to the value of surface cultivation of the soil, particularly during the dry hot months of summer. There seems to be an impression amongst many of those who cultivate the soil, that the harder the surface is allowed to remain, the less danger there is of evaporation taking place, and gardens may be seen almost everywhere, having the soil as hard almost as stone. The idea of not cultivating the surface is most erroneous, and all those who are adopting the suggestions offered in these gardening notes are strongly urged to keep the hoe or cultivator at work as frequently as they can. It may not be out of place to mention that orchardists should keep a cultivator continuously at work, day after day during the summer, weather permitting. There should be no room for weeds in either vegetable garden, orchard, or farm. Weeds are not wanted; but judging from the appearance of the majority of orchards in this Colony, the owners seem to favour their growth. Constant cultivation will do away with weeds altogether, will invigorate the plants, and will prevent the evaporation of moisture from the soil. A heavy mulch of farmyard manure will prevent evaporation and serve as useful plant-food as well, and when dug into the soil after it has served its purpose as a mulch will prove valuable, not only as a plant-food, but, during its process of rotting, will perform important work in making the soil better adapted for plant growth.

Many of our soils are deficient in vegetable matter, a defect which it is most important should be remedied. On the farm where large areas are cultivated, this can be best done by ploughing in green crops; but in the home vegetable garden the droppings of domestic animals will have much the same effect.

During the month of January the application of liquid manure will be found to be of considerable value to growing vegetables. It may be pointed out that the crisper and more tender the vegetables, the more valuable they are for use, so that the quicker they are grown the better, and the less chance there is that they will run to seed, which is only too frequently the case with such plants as cabbage and lettuce. The liquid manure need not be made very strong, and it is not likely that this will be the case if it is made from the droppings of animals. If, however, it is prepared from "artificial manures," such as sulphate of ammonia, superphosphate, or from specially prepared concentrated manures, considerable caution must be used. Again if the urine of animals is collected and allowed to ferment, it becomes very strong, and will need to be considerably diluted with water. This latter manure is exceedingly valuable, and should always be collected where possible from stables, &c.

Any seeds that may be sown now should be carefully looked after, watered, and shaded. If just sown and left to themselves they will probably perish. Seedlings that may be planted out will need care and attention until they become firmly established. The plants should be watered thoroughly before they are taken up, and watered again after they are planted, and if necessary the watering should be continued for a few days.

It will not be necessary to plant out much at a time if a succession of planting is carried on, therefore although it may appear that all the care suggested amounts to a great deal of work, in point of fact there is but little trouble in it. Half a dozen cabbages a week need take but a very few minutes to plant with the greatest care, and even to prepare and manure the land for, but in the course of a year these will make a total of upwards of 300. And so on with other vegetables. The great secret of success in vegetable-growing is never to allow any part of the garden to remain idle, and then a surprisingly small portion of ground will be sufficient to supply the family with all the vegetables they can consume. How it is that all those who live in the country and have any spare ground about their houses, and a very little spare time, do not grow all the vegetables they need is a puzzle. Perhaps these notes and suggestions may prove useful to those who know little or nothing about vegetable-growing, but if anything else should be required, the readers are invited to write to the Department of Agriculture for any information they may need.

Bean, French or Kidney.—This vegetable may be sown as largely as may be required. The best plan to adopt is to sow a row or two once a week, or perhaps it would be better to sow a row, wait until the plants have come up, then sow another row, and so on. The ground should be well dug before sowing, and if it is not naturally sufficiently rich, it should be heavily manured with well-rotted farm-yard manure. It may be as well to state that if chemical or artificial manures are used, sulphate of ammonia, nitrate of soda, or manures known as nitrogen or ammoniacal manures, are of little if any use for French beans. Lime, gypsum, potash, or sulphate of lime are the best substances to apply, but it is hardly possible to do better than apply plenty of well-rotted stable or farm-yard manure for any vegetables whatever. This is always safe, and, as a rule, most effective.

Cauliflower.—This month is a good time to plant out cauliflowers from the seed-bed. In the first place, prepare some ground by trenching if possible, or deep digging, and thoroughly well manuring, mixing in the manure well. If the soil is dug or trenched deep the roots of the cauliflowers will descend to a considerable depth in search of food, and will not suffer from dry weather. Select good strong sturdy plants and set them out about 3 feet apart each way. Do not break or injure the roots more than can be avoided when raising the plants from the seed-bed. Sow a little seed in a seed-bed or box where it can be shaded or watered easily.

Cabbage.—Sow a little seed and shade and water. Put out a few young plants in well-manured and well-prepared ground.

Celery.—A little seed may be sown, and a few plants put out in well-manured or rich ground. This vegetable will need to be well watered and also treated to occasional supplies of liquid manure.

Carrot.—Sow a little seed in drills, taking care to separate the seeds well before they are sown. Thin out any young plants that may be coming on, and be careful to keep them free from weeds.

Lettuce.—Instead of planting out from the seed-bed it will be better, at this season of the year, to sow in rows in a richly prepared bed in the garden

and thin out the plants to about 9 inches apart when they come up. If lettuces are transplanted just now they are very apt to run to seed.

Peas.—In the coolest parts of the Colony a few rows may be sown.

Potatoes.—Prepare a bed for planting by deep digging, well draining, and heavily manuring. When ready, plant some variety of the kidney potato. Use medium sized whole tubers, for they will probably succeed better than large ones cut into two or more pieces. The rows should be from 2 feet 6 inches to 3 feet apart.

Red-beet.—Sow a row or two of this useful salad vegetable on some ground that had been previously heavily manured for cabbage, potato, or some other crop. The seed will probably take a long time to come up, especially if the ground is dry. If it be thoroughly soaked in water before it is sown and the drills in which it is also well watered it will come up much sooner.

Tomatoes.—In most gardens there should be good supplies of ripe fruit. Some means should be adopted to keep the branches or vines from lying on the ground and thus rotting the fruit. They are awkward plants to tie up if allowed to attain full growth before the tying up is attempted. The work should be done as they grow. Bundles of sticks, prunings of fruit-trees, or dead branches of trees can be spread under the plants, and this will answer in a rough way to serve the purpose. If required, young plants may be put out to keep up a succession of fruit.

The month of January is generally considered to be an "off" month for vegetables, and there is often a scarcity if the weather prove to be dry; but with a little care and trouble, if a good supply of water is available, quite sufficient may be raised for all requirements.

If onions are ready for lifting care should be taken to do the work without bruising them, and after they are raised do not, on any account, leave them in the sun to dry, or else they will not keep for any time.

The Flower-garden.

As, no doubt, anyone who takes the trouble to grow his own vegetables is almost certain to grow a few flowering plants, it may not be out of place to give a few hints for the guidance of those new to the work. It would be well to mark with strong, short stakes, the places where bulbs are growing, for they are now casting their leaves, and probably their places will be forgotten and the bulbs injured. If desired the bulbs may be taken up and stored away in a dry, airy shed or outbuilding until required later on for planting. But there is no necessity, really, to raise the bulbs unless to divide them. Many roses will cast their leaves about this time of year, especially if the weather is dry. They may be pruned back, just as if it were winter or early spring, and the plants will produce good flowers in the autumn. Many of the tea-scented varieties of roses will probably bloom well. They are the most useful class for small gardens. The best flowering plants for the summer and autumn months are the Bouvardias, of which there are many beautiful varieties. Chrysanthemums will need good supplies of water, and also weak liquid manure. The plants had better be well mulched with farm-yard manure. Dahlia plants should be tied up to stakes as they grow, and they will need plentiful supplies of water and liquid manure. Small plants like cowslips, daisies, or polyanthus, if allowed to remain in the garden fully exposed to the hot sun, will be very likely to die. They had better be watered, and removed to a cool, shady place for the remainder of the summer, and can be replanted in their old situations in the winter or early spring.

Orchard Notes for January.

All over New South Wales the month of January is a very busy one for fruit-growers, the principal work of the month being the gathering and marketing of the fruit, which will consist largely of apples, pears, plums, passion-fruit, peaches, nectarines, figs, grapes.

Apricots and cherries, except in the latest districts, will have been finished in December.

During the month there are sure to be one or more gluts of fruit. On this account too great care cannot be taken to so pick, grade, and pack the fruit so that it shall show to the best advantage, as, even in a glutted market, really good fruit, well shown, always sells well. There is sure to be a great surplus of second-rate fruit, and this will continue year by year until our fruit-growers learn by experience that more money can be made by growing only a few varieties of each kind of fruit—and those of the best kinds—than by growing every variety that they can possibly crowd into their orchards. A great deal of this second-rate fruit is very hard to dispose of, as it is valueless to the canner or drier, and will not even make a good jam. Its only value is as fresh fruit, and for this purpose there are many fruits very superior to it, that are also valuable for canning, or, when evaporated, form a saleable article. Although the gathering and marketing of the fruit will take up the most of the orchardist's time, the cultivation of the ground should not be neglected, especially in the drier districts of the Colony, where, owing to the sun heat, it is absolutely necessary to keep the soil of the orchard in as fine a tilth as possible, so as to minimise the loss of water from the surface by evaporation. Where means are available for irrigation in the dry districts, a watering should be given during the month to the later varieties of fruits, care being taken to cultivate the land that is irrigated as soon as a horse can be got on to it without packing the soil. If this is done no further irrigation will be necessary, as the water will be retained in the soil so as to meet the tree's requirements. During the month there is not likely to be much occasion for spraying, except grass-hoppers, crickets, or locusts appear, and defoliate the trees, when the use of Paris green is a very effectual remedy. Codlin moth will also have to be fought all through the month by means of bandages, which should be removed every ten days, and all the larvæ found in them destroyed. All cases that have held wormy fruit should also be dipped in boiling water, so as to destroy the larvæ or pupæ of the moth that may be in hiding in the crevices. This is of especial value in districts that are now free from the moth, as the great means of bringing the disease to these districts are the old cases that are returned to the orchardists, and that have been used to carry wormy fruits. During this month it is advisable, in the case of cherry orchards, to do all the heavy pruning that is required—that is to say, all broken branches should be removed, and if there are too many main limbs that are crowding the tree they should also be cut out now, as the cherry is less likely to bleed (gum) soon after the crop is gathered than at any other time of the year. If a big limb has to be removed, always trim the edges of the cut with a sharp knife, and cover the wound with either grafting-wax, rubber paint, or shellac varnish, made as recommended in the *Gazette*.

General Notes.

Trade with Canada.

In view of the intimation by Mr. Mackenzie Bowell that his visit to Australia was largely with the view of opening up trade relations between Canada and Australia, steps have been taken by the Department of Mines and Agriculture to bring the industries it represents prominently under notice. The Minister for Mines and Agriculture caused to be forwarded to Mr. Bowell, on board the s.s. "Arawa," samples of lemons grown in New South Wales which were cut from the trees in the early part of July last and carefully placed in open cases, which were stored in an open shed and allowed to sweat for about a week. The fruit was then examined, and all sound fruit was wrapped in paraffin paper and packed in ventilated cases. Since the beginning of August the fruit has been stored in the cases in a well-ventilated cellar, having a fairly-even temperature, and the loss up to the date of the sailing (18th November) did not exceed ten lemons per case of 150 fruits. It was pointed out that a large quantity of lemons equal to the sample were available for export annually during the months of May, June, and July. There was also sent a small box containing samples of essential oils and perfume waters obtained from citrus fruits, together with notes on the individual samples. As representing the timber industry, a few samples of wood-paving blocks ready for use, together with others showing wear, consisting of tallow-wood, blackbutt, red gum, blue gum, mahogany, brush box, and turpentine were also sent, accompanied by a report from the City Surveyor with reference to the system of paving with these blocks in the city of Sydney. To this was added copies of "The Timber Trees of New South Wales" and "Australian Timber."

It should be mentioned that this important preliminary step was taken in consequence of the kind offer of Mr. Bowell to take charge of exhibits which it was desired to bring under the notice of Canadians, and in such capable hands the fruit and timber industries, as well as others which it is understood are also represented in like manner, can hardly fail to be substantially stimulated.

Analyses of Manurial Matter.

The following analyses have been made by Mr. F. B. Guthrie, the Departmental Chemist:—

A sample of what is known to tanners as "scutch," was recently received for analysis, with the following results:—

Water	5·32		
Organic and volatile matter ...	73·42	Nitrogen	1·80
		Ammonia	2·18
Sand and insoluble matter ...	3·61		
Calcium phosphate	1·32	Phosphoric acid ...	·89
Lime	9·36		
Potash	·20		

The manurial value of this refuse would be about £1 5s. per ton.

A sample of a substance known as "Coarse Awful" or "Ashmagandy" has given the following results on analysis:—

Water	4·90		
Volatile and organic matter ...	34·09	Nitrogen	2·52
		Ammonia	3·06
Sand and insoluble matter ...	10·46		
Calcium phosphate	47·41	Phosphoric acid ...	21·71
Other lime-salts as carbonate...	2·22		

This substance is in a very coarse state, and contains an excessive quantity of sand and insoluble matter. Its value as a manure is about £1 per ton.

A sample of digestor refuse from the Young district, consisting of bones, etc., of dressed carcasses (after extracting tallow and soup) dried and ground, has given the following results on analysis:—

Moisture	8·68		
Volatile and organic matter ...	29·24	Nitrogen	3·283
		Ammonia	3·986
Sand	2·81		
Calcium phosphate	51·91	Phosphoric acid ...	23·77
Other lime salts as carbonate...	5·42		

This should prove a very valuable product containing, as it does, high percentages of nitrogen and phosphoric acid in good mechanical condition. The value, according to this analysis, is £5 10s. per ton.

Distribution of Tobacco Seeds.

In order to carry out a number of experiments to ascertain the most suitable districts for the cultivation of tobacco, and to introduce new varieties to the Colony, the department, in compliance with the recommendation of the tobacco experts (Messrs. Lamb and Sutherland), imported seeds of twelve specially selected varieties of tobacco from the United States. These seeds, together with seeds of four other varieties obtained from the Departments of Agriculture of Queensland and Victoria, were distributed in a number of districts to farmers wishing to carry out experiments. As showing the interest taken in this matter, it may be stated that no less than 346 applications were received for this seed. One thousand and sixty-five packets were distributed among the applicants.

As several complaints have been received regarding the germination of the seed, a careful test of these varieties was carried out by an officer of the department, the results of which are appended for the information of farmers who are experimenting. As will be seen on reference to the table, several of the varieties germinated very poorly, but the majority gave a very good return, and the average of forty-five must be considered a very fair one, especially as the seed was imported. One hundred seeds of each variety were counted out for this test, in order that the exact percentage might be obtained. Of course, it was to be expected that in some cases the seeds would fail. There are many reasons why the seed might not germinate, or show no appearance of having done so. For instance, the sowing may be too roughly done; the seed-beds may be made a little uneven; in watering the beds the seeds may be washed to the surface, and killed by the sun, or the seed-beds may be allowed to get too dry, and as a consequence the sprouted germs are killed. Given proper care in sowing, preparing the seed-

beds, and watering, there is no reason why the percentage of plants obtained should not equal that given in the following table:—

No.	Name of Variety.	Germinated in number of days.	Percentage of seeds germinated.
1	Big Frederick	6	89
2	Connecticut	7	63
3	De Hongrie Debroe	7	67
4	Fly River	9	63
5	Havanna	10	16
6	Hester	10	17
7	Hyeo	10	22
8	Maryland	9	61
9	Orinoco	11	6
10	Primus	5	88
11	Sterling	10	23
12	Tuckahoe	11	9
13	Virginia	6	79
14	White Burley	8	47
15	Yellow Prior	10	14
16	Yenidjek	8	56
	Average	8·5	45

Hawkesbury Agricultural College.

There will be from ten to fifteen vacancies for students at the Hawkesbury Agricultural College, to be competed for at the examinations which take place at the end of January or the beginning of February. Parents, therefore, who desire their sons to enter upon a course of agricultural training would do well to see that their applications are made without delay, as to which full information can be obtained by communicating with the Department.

LIST OF AGRICULTURAL SOCIETIES' SHOWS, 1893–4.

Society.	Secretary.	Date of Show.
		1893.
Alstonville and Richmond River F. C. A. and H. Society	P. J. Daley ...	Dec. 19, 20
		1894.
Dapto A. and H. Society	A. B. Chippendall	Jan. 9, 10
Kiama A. Society	J. Somerville ...	Jan. 25, 26
Sutherland H. and I. Society	W. Douglass ...	Jan. 26
Wollongong A. Society	A. J. A. Beatson	Jan. 31, Feb. 1
Manning River (Taree) A. and H. Association	W. Plummer ...	Feb. 14, 15
Tumut A. and P. Association	W. H. Bridle ...	Feb. 20, 21
Marulan P. A. H. and I. Society	H. Morice ...	Feb. 23
Candelo A. Association	C. H. Brooks ...	Feb. 27, 28
Tenterfield P. and A. Society	J. Harker ...	Feb. 27, 28, March 1
Port Macquarie A. Society...	A. E. Poutney ...	Feb. 28, Mar. 1
Lismore A. Society	C. S. Connor ...	Feb. 28, March 1, 2

[2 plates.]

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